HM Government

Geospatial Commission

Call for Evidence - Submitted Responses

Introduction

In August 2018, we published a Call for Evidence that asked 21 questions about the value and relevance of geospatial data. We are grateful for the high quality and number of responses we received from a broad range of stakeholders.

The questions we asked are listed below:

Q1 Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

Q2 In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

Q3 What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4 How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

Q5 Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6 How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

Q7 Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8 How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9 What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10 What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

Q11 What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12 Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13 How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14 Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15 How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

Q16 How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

Q17 As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified:
• property and land
• infrastructure and construction
• mobility
• natural resources
• sales and marketing

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

Q18 Are there any other areas that we should look at as a priority?

Q19 What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

Q20 How best can we make the UK's presence in the international geospatial world more visible?

Q21 Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	1Spatial Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

1Spatial suggest that the Commission should consider the geospatial supply chain and differentiate between geospatial data and geospatial information. Geospatial information is typically derived from data and information is used to create knowledge for decision making. Geospatial data is raw, unorganised facts that need to be processed. Data can be something simple and seemingly random and useless until it is organised. When data is processed, organised, structured or presented in a given context so as to make it useful, it is geospatial information. Positional data and identifiers are all characteristics of geospatial data. Geospatial services are characteristic of information. Is the Commission focussing on data and information? 1Spatial recommends that it should be both, as information is represented as products and services e.g. OS MasterMap. Geospatial data can be explicit or implicit. Explicit geospatial data directly represents locations as points, lines or polygons. Implicit geospatial data indirectly represents locations as place names or addresses. This could be what is referred to as positional data. Approximately 60-70% of geospatial data/information is implicit.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The UK has fantastic geospatial skills. There is a need to align core geospatial skills with underpinning technologies notably Internet of Things, Artificial Intelligence, Cloud and Mobile. Everything happens somewhere, and geospatial skills, knowledge and expertise is at the core of these technologies.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

1Spatial want to look at geospatial apprenticeship schemes. 1Spatial is an SME and therefore limited in terms of breadth of experiences it can provide to apprentices. Is there an opportunity to establish combined government and private sector/SME geospatial apprenticeship schemes? Individuals could gain experiences working in government and the private sector. How can government work with SMEs to promote geospatial skills? Government's is very good at providing forums etc for government geography/geospatial professionals to network or learn from each other. Is there an opportunity for SMEs to get involved?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The Commission should prioritise accessibility to geospatial datasets based upon government policy, strategies and plans and the needs of delivery bodies/agencies/organisations to deliver against these policies etc. For Example, UK's Government 25 Year Environment Plan articulates a shift towards environmental enhancement and public goods goals. In order to deliver and monitor these goals will require access to public sector geospatial data pertaining to the natural environment e.g. land parcels, land cover, land use. Another example is the UK's Government strategy to accelerate house building. In order to plan and design housing developments there is a need for high quality data/information about underground utlity assets. Limited access to high quality and interoperable underground assets data/information is a major barrier to accelerating and creating efficiencies with housing planning and design. Too much time is spent sourcing and integrating underground asset data/information.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Georeferenced address data e.g. OS AddressBase is often the starting point for enabling users to clean, validate, match, enhance and visualise their business data/information. Typically, organisations use standard address matching software and georeferenced address data to do this. Users are typically reliant upon a single source of georeferenced address data to carry out the cleansing, matching etc. There is a need to look at the wider address ecosystem in terms of how different address datasets can be integrated and used together to provide enhanced address data cleansing, matching etc. Ordnance Survey could be regarded as providing the authoritative source of georeferenced address data but there are many other sources of authoritative address data in government e.g. Valuation Office Agency Non-Domestic Rates that are useful for different purposes. How can different sources of government address data be integrated? Sectors like insurance need enhanced address data (including address, property/building type and use, building size, number of floors) in order to make robust risk assessments. There are limitations with standard address matching approaches. The inherent problem with address matching is the diversity of the addressing conventions, abbreviations, fields and erroneous data input. Given this diversity, experience would suggest that where an asset is associated to an address, matching schemes based on best practice can only achieve in the region of 85% synchronisation. Nationally this could lead to tens of millions of unmatched addresses. In addition, there are complexities with new build developments where addresses are delivered after completion which does not support the delivery of core infrastructure during the construction (water, gas etc).

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Commission should be looking to invest in centralised and co-ordinated EO data management and access for the benefit of the public sector and private sector. EA data is fundamental to monitoring built and natural environment changes and therefore modelling and analysing changes to our environments. EO data needs to be readily available enabling user to model and analyse EO data overtime. The economic value that can be gained through automated change detection from EO data is huge and the Commission has an opportunity to faciliate the development of the UK's EO data capabilities and turn EO data into usable information for analytics/modelling and decision making.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Need to think about “machine to machine” use of data as well has human operator use of geospatial data. Machine use requires higher levels of automation and therefore a greater focus on data quality, data integration and data interoperability. We need to efficiently turn geospatial data into geospatial information for machine and human operator decision making. The Internet of Things will demand this. Currently the majority of decision making using geospatial data is human operator driven.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data is integral to the Internet of Things, Artificial Intelligence, Cloud, Mobile and Big Data. As per Q7 geospatial data needs to be easily consumed via machine to machine, machine to human and human to human mechanisms. If the public sector doesn't make its geospatial assets available in this way businesses will by-pass the public sector and find alternative ways of capturing or sourcing similar data/information, for example from commercial suppliers or crowdsourcing.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Centralised and collaborative investment in maintaining and enhancing our geospatial data assets, based upon prioritised data assets. Geospatial data needs to be collected, maintained and shared. Investments are needed ensuring data quality, data integration, data interoperability and data accessibility. Through this investment we can generate geospatial information and increasingly integrate different sources of geospatial data together and bring these sources together as information. Individuals and organisations spend too much time preparing geospatial data and turning it into usable information. The public sector has a role to play to enhance its data assets and turn data into usable information to stimulate new innovations and applications using geospatial.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Focus investments on "stewarding" geospatial data and turning geospatial data into information as part of the underpinning geospatial infrastructure. With emerging technologies, for example sensors and earth observation the challenge will be "stewarding data" - collecting it, maintaining it and sharing it. “Garbage in equals garbage out”. Investments are needed in turning geospatial data into information and making information accessible for machine to machine and human operator use for decision making. Geospatial data should be integrated, brought together from different sources for different purposes and accessible as information.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

The private sector should provide enabling technologies and services/processes to build and support the maintenance of underpinning geospatial data infrastructures. This includes 1) geospatial technologies for GNSS & Positioning, Earth Observation, 3D Scanning 2) Services/Processes for business intelligence, workflow automation and digital engineering. The private sector should provide technologies and services/processes to enhance the UK's geospatial data assets by enabling data to be transformed into information. This includes standards, interconnected systems and data, workflow automation and digital engineering.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

1Spatial's core business is working with geospatial data and in many use cases transforming data into information. 1Spatial works with a wide range of public sector geospatial data including mapping data, land and property data and transport data. The biggest challenges 1Spatial faces are associated with 1) maintaining data stewardship - collecting data, maintaining data and sharing data, 2) turning data into information and 3) aggregating data/information from different public sector sources, in order to solve specific problems or answer a specific question. 1Spatial would like to see greater collaboration between those public sector organisations that are stewards/custodians of geospatial data to enable improved interoperability. There are great examples of individual organisations enhancing their own geospatial data assets, for example Ordnance Survey or HM Land Registry but not enough focus on public sector organisations working together to make data/information interoperable. A good example where the public sector has collaborated around a specific problem is the Natural Hazards

Partnership - government collaborating and aggregating data/information to solve natural hazard scenarios - wind, landslides, flooding. This is not so much a technical challenge but about defining the real problem, what data/information is needed to solve the problem, aggregating data and making data interoperable, to solve the problem.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission needs to work with industries (priority areas for example, mobility or land and property) to better define user needs and problems. The commission can then effectively get the public sector to work together to meet user needs and problems using geospatial data. Technical and non-technical solutions will be needed by the public sector. Many of the barriers associated with geospatial data/information are non-technical. The Commission can be more effective by governing and facilitating collaboration across the public sector. Public sector organisations often have different views of public value/public task (financial,ideological, political, quality of life, social, stewardship or strategic) and the mechanisms (efficiency, effectiveness, enablement or intrinsic enhancement) by which they deliver public value/task. The Commission needs to find common ground for public value and the mechanisms for delivery. This is something that the private sector cannot faciliate. "The private sector can implement change and innovation but the Commission needs to facilitate change and innovation through influencing public value types and mechanisms for delivering public value" starting with the public sector.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

1) Linked/interoperable geospatial data networks for mobility - connected/interoperable multi-modal network geospatial data. Connected mobility networks are a high priority and core reference geospatial data for the public sector – transport/mobility use cases. 2) Linked/interoperable building and land use geospatial data - land use lifecycles - land and property, infrastructure and natural resources use cases. 3) Aggregated property geospatial data - land and property, infrastructure, natural resources use cases. 4) Aggregated location index - register of locations - multiple use cases. Access needs to be machine readable and human readable. Geospatial data needs to be accessible as information for modelling and analysis, for example use of grids. Geospatial data already exists across the public sector but not always aggregated, connected/interoperability and accessible.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Geospatial is at the core of so many other UK strategies. The UK Geospatial Strategy needs to connect to 1) government strategies and investments pertaining to vertical priority areas - land and property, mobility, natural resources etc and 2) horizontal/cross cutting strategies - Industrial Strategy, Centre for Digital Built Britain etc.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Local government is probably the biggest single source for geospatial data that is critical to delivering local operational services, shaping future policies and investments - locally and nationally. Some local authorities have published their geospatial data on local, regional or national portals as open data, but many have not done so yet. There is a lot of duplication and silos associated with geospatial data stewardship across local government. There is a need for co-ordination around delivering common services, policy/strategy/shaping and future investment. A good example is the Greater London Authority (GLA) identifying a need to co-ordinate planning and infrastructure data from 35 local authorities - https://www.london.gov.uk/what-we-do/business-and-economy/better-infrastructure/progress-update. It is estimated it could significantly reduce the almost £3m in spending by planning departments across several services.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

1Spatial could discuss specific geospatial applications with the Geospatial Commission that could be scaled-up and/or developed to capture economic value.

Q18: Are there any other areas that we should look at as a priority?

1Spatial agrees with the priority areas that the Commission has put forward. There are strong links between geospatial data, built infrastructure and natural infrastructure, as outlined by the National Infrastructure Commission and the National Infrastructure Assessment. In terms of built and natural infrastructure the Commission should prioritise enhancing geospatial data/information for low carbon energy, the future of the UK's roads, encouraging growth of cities (transport, employment and housing), tackling floods and cutting waste.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Innovations for low carbon energy, the future of the UK's roads, encouraging growth of cities (transport, employment and housing), tackling floods and cutting waste depend upon the use of public sector and private sector geospatial data. There are regulatory challenges as the public sector geospatial data needed to drive innovation around these needs is not always openly accessible e.g. for licensing reasons or innovations are dependent upon open access to geospatial data from the private sector e.g. utilities. Regulation may be needed to ensure that the right geospatial data is openly accessible to drive innovations.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

1Spatial recommends that the UK's presence internationally needs to be measured and presented from an outcomes perspective e.g. based upon the priority areas and Commission objectives. The UK has led the world in showing how opening up geospatial data delivers business growth. However, we need to continue demonstrating and presenting the economic, environmental and social value of geospatial data e.g. how is geospatial data/information tackling flooding or cutting waste. These are challenges that every country in the world is facing.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Whilst there are many international exemplars across the globe e.g. Singapore, these examples are typically "new" cities without always having legacy challenges e.g. aging infrastructure. The Commission should look at comparable countries to the UK. The Countries Geospatial Readiness Index is a great starting point. The top 10 countries excluding UK - USA, Germany, Singapore, Netherlands, China, Canada, Denmark, Switzerland, France.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	2Excel Aviation
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**x**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It is very frustrating when government uses the term Earth Observation or EO data to describe only data acquired from satellites. Data available from other platfroms such as UAVs and aircraft also provide very important earth observation data in both government and industry and these are often ignored. There have been exciting developments in the sensor capabilities from these platfroms as well, such as the Optech Galaxy LiDAR sensor used by the Environment Agency that has enabled them to undertake their programme of national coverage.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The use of open source software and programming lanuagues. Govenrment departments are often still relieant on commercial software (e.g. ESRI ArcGIS). While these have their place in the geospatial sector, many of the open source softwares are provding innovative approches to manipulating and processing. If government provided greater empagsis on the requirement for skills in open source software (e.g. QGIS) and programming (e.g. python and R) then universitites could respond to this. They want to prepare their graduates for jobs in the market.

With larger datasets and more complex anslysis required to get the best out of geospatial data, people entering the field need to have a stronger programming background than traditional geospatial training currently provides them with.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

It is extemely difficult to find people who have a training in remote sensing and GIS who also have high level programming capbilties. We tend to have to employ data scientists/physicists with high level programing skills and remote sensing experts together. We desperately need individuals who can do both.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

For commercial users working on small bespoke projects across the country the OSasterMap is too expesnive to source for each individual project. As a result we have to spend a lot of time effectively trying to replicate this dataset. Having open access data to key infrastructure and building footrpints would be extremely useful.

Whilst I understand why the Enviornemnt Agency LiDAR campaign collects during leaf-off conditons (for good DTM for flod modelling). This data then has a very limited use for Forestry Applications. If the sensor was also used during the summer months it could support work concerned with forest health, tree species, timber estimations etc.

I am also not entirely sure what aerial iagery campagins the government commissions. It is my understanding that some national coverage is commissioned every few years. Ths would be very valuable for all kinds of applications suchas verifying satellite data, assessment of change and georectification.

For project planning it is also useful to have a clear plan of what data the govermnet plans to collect and produce and when these would be avialable to incorperate into analysis. For example every year hundreds of undergraduates have to undertake dissertation projects. If the government had clear information about all the geoptial data available then universities and students could make the best use of this resource.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

More coherent way of accessing and QUERYING all government geospatial data.

e.g. I am conducting a research project in area X what are all the avaiable datasets I could use to analyse the area.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Whilst space is a key part of the EO stratgery other EO platforms (e.g. UAVs, aircraft) seem to have been neglected by government stratgery and funding. To be a world leader in earth observation we need to use the right platform and sensor for the application. The comsion should have a much more holistic view to EO where UAV, Airbrone and space data are integrated to provde solutions across different scales. It would be rellly nice to see more funding calls looking at data integration rather than simply just exploiting data from the ESA satellites.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No specific comment.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No specific comment

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Consideration should be given to how the Environment Agency LiDAR sensor could be used during the summer months to collect datasets useful for other sectors such as Forestry, Conservation (any vegetation related assessments). Or even allow the sensor to be used by other orgainsiations during this period.

Also having national EO standy/reponse to caprure data important following/during environmental e.g. Saddleowrth moor fire. Having an airborne dataset after the fire would allow some assessment of the impacts of the burning.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No specific comment

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Government needs to be clearer about the datsets it intends to collect and make available so industry can plan according to fill the gaps in the market (specifcaaly with regard to airborne acquisitons)

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Whilst datsets may be available for prticualr area of interest the timing of collection may not fit within the scopre of the study. If as end users we had a clear plan of when certain data types were due to be collected then projects could be desgined to incorporate these datasets.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Whilst many geospatial datasets have applications across diferent industries, each industries requirements for the data e.g. time collected, resolution, data type – its important the Commission recognises the need from each industry rather and plans accordingly.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

All departments need to be better informed about the beneifits and limitation of Earth Obervations. E.g. some people think Sentinel-2 is the anser to everything and don't appreacite the limitations of the satellite resolution. Others have no background at all and find any converstaions/engagement about GIS and EO overwhelming.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**

- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Use EA LiDAR to collect LiDAR dataset for Foretry Commisoon during Leaf on conditons. This would be a great example of taking one asset from one gov organisation and using it (when its sat doing nothing) for another department.

Q17: Are there any other areas that we should look at as a priority?

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Much clearer plan is needed on UAVs re likely to be regulated in the future. There is lots o wok in developing smaller sensors to b carid by UAVs but the sector need to kno how thes are going to be regulated in the future to plan for them.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Firdtly its using our own data to solve our own problems. Thi will highlight ho the UK is using EO and GIS in an innovative way and other wl want to learn form that.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In th case of Forestry, Canada has some of the best examples of the application of EO for forset management.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name [Text Redacted]

Organisation 2excel geo

Job title [Text Redacted]

Address [Text Redacted]

E-mail [Text Redacted]

Telephone [Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent Please mark with a X

Academic

Business representative / trade body

Central government

Charity or social enterprise

Individual

Legal representative

Local government

Large business (over 250 staff)

Medium business (50 to 250)

Small business (10 to 49)

Micro business (up to 9) **x**

Other - please state

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I would say the definitions of data types is accurate

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Having been through the education system for geography I would say introducing geospatial software early is important. It has been a while and maybe things have changed but there was relatively little variety in what was taught outside ArcGIS. It was not until I went to my masters that I used QGIS. I think processing data with code will also become increasingly important, therefore developing python skills could help with this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Once again I believe there is a greater need for integrating programming into image analysis for geo applications. As well as this, exploring other methods of analysis. We use hyperspectral aerial imagery in our company and I feel that it is very niche because not many people talk about it – rather there is a focus on multispectral space sensors. Teaching a greater awareness of techniques and methodology as well as coding methods to analyse the data

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One thing which I would find really useful is the OS maps building layer/black and white base map which is available on magic maps. I make a lot of habitat maps and

it would be nice to overlay my classifications on a background like this. It is very expensive to buy this each time, especially being a small business and working on reatively small areas like we do. Having the EA Lidar for the whole would be really useful, but I know this is coming.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data is not something I use

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Although space EO is important I believe there is a bias to this and some naivety in the capabilities of satellite datasets. Rather, focusing on a wide range of systems such as UAVs, aerial systems and satellites with multiple different sensors(radar, visible, lidar, hyperspectral...) and not just limiting growth to one sector of the market. Having a solid pyramid of EO data sources which promotes collaboration within the private and public sector is important

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I have spoken to many people who have said their companies have drones and they are looking to put on hyperspectral cameras. There is not much understanding on the capabilities of hyperspectral data but I believe it is invaluable in

understanding earth processes. As well as this, a greater focus on aerial imagery would be useful as mentioned in my answer to Q6 there are some applications where satellite imagery resolution is not high enough and if companies need this data they will currently go to another supplier (I do not believe there is a large UK supplier of high resolution satellite data – though maybe I am wrong)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

I believe that hyperspectral aerial remote sensing has many benefits for future technologies and applications. For one, within conservation it can improve the land cover classifications and phase 1 habitat maps. This means that there can be a better collaboration between on the ground collectors, improving their classifications and also meaning

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

I think collaboration is important. Using other companies to provide other datasets and enhance the understanding of a geospatial dataset e.g. different resolution levels, different data types. I think a high return period on databases would be useful and maybe making portals to look for data within a certain area(a bit like the magic map or sentinel playground but with different data types of a searchable area within a certain timeframe) Making a master website with a list of available resources, more transparency and more free datasets to encourage geospatial business growth.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

I do not think that indoor positioning systems are the most important systems. When doing fieldwork we use a GPS within our tablet which is accurate to 2-2.5m. I think improving these capabilities for GPS systems would benefit our work – particularly for tree species mapping where it is important to find specific trees.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Outsourcing specific jobs and promoting communication and collaboration within the geospatial commission should help with improving data assets within the private sector. I believe that there should be a better communication between government organisations about what major problems are being faced and how the private sector can help – making geospatial data assets more relevant.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

See Q9

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Not relevant

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Not relevant

Geospatial Commission: Call For Evidence Response Questionnaire 6

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Not relevant

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Geospatial Commission: Call For Evidence Response Questionnaire 7

We have been looking particularly at forestry, agriculture and conservation. I believe these areas stand to make the most money for monitoring and more geospatial information

Q17: Are there any other areas that we should look at as a priority?

Urban areas, environment, agriculture

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

I think that agriculture could really benefit from more geospatial data, as well as conservation bodies and local councils

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Building upon understanding of new techniques e.g. hyperspectral, putting emphasis on different methods of collection and finding unique ways to solve problems which are globally applicable

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Having done my masters in Germany I have a fairly good understanding of the geospatial market and I would say that there is a strong integration of geospatial jobs within regular industries – many different companies have geospatial professionals. Additionally there is a large research base – for instance the DLR(German aerospace centre) which integrates research with different private sectors

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	2Excel geospatial
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yeap.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Focus on market size and the end customers for each use case, in order to alleviate from market pentration strategies and fund retaintion on new businesses. From my experience there are a lot of bodies that need partnership especially between the academia and the industry which most of them are addressed from KTNs but most of the bodies as is still in research is unsure about their investement and their product"s adoption rate, making an effort to unblurry the market would boost productivity in my opinion.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As mentioned product management personell should be needed to narrate research into products.

Then more from my personal experience more promotions in relevant areas such as machine learning in order to build a better foundation and incorporate the state of the art AI tools. It seems to me that the machine learning community is mostly driven by other market areas since there are more pronounced values and profit.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Specifically for our company the retention of additional data and shared data it is firmly believed that would make more crisp the potentials of each of the data source. Easily one could distinguish that combining data sources with our local sources it would leverage both the datasets value. Evidence for the prior claim are various literature claims and past competitions which invoke companies to accomplish that. Moreover, letting companies to combine resources would need to leverage their capabilities and effectiviness of using many resources; which would cutlivate and prepare each company for future endeavours.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

N/A

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

N/A

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Sharing and distributing open access data. Possibly, a blockchain technology to compensate people who share their data.

Computer science tools for reproducability of techniques and managing data sources pipelines.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

From a Data Scientist perspective, define datasets and metrics for research entities to claim efforts upon. Similarly to the MNIST dataset for recognising hand writings.
For instance for the probelm of habitat mapping there could be a training map and a test map for each of the contestents to train and predict. Moreover, statistical reporting metrics should be validated cause from my experience they are used many times falsely claiming unknowingly overfitting results as their success.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

N/A

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Partnering with such kind of companies (for instance moblie phone companies) and understanding their problems and their targets would help companies such as ours to possibly collaborate with them and leverage our datasets.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Sharing datasets, strategies and techniques in my opinion should be under consideration for both parties.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

I"ve been using mostly in house data, then I have used some from the government agecny which I would say the web tools are quite understandable I wouldn"t emphasize on something.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

N/A

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

High resolution satellite imagery, historic imagery would be some that I think we would like to have access to.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Possible casual meetup events after work could link local authorities and get familiar with us (i.e. companies) and discuss about opportunities and familiarise with each other.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

From our perspective precision agriculture, habitat mapping, forest preservation (i.e. tree disease, tree species) are sectors that need a lot of research but once finalised and there is a stable product then could change the whole industry.

Q17: Are there any other areas that we should look at as a priority?

The merge of multi sensor applications. For instance combining drone, airborne, satellite and on ground sensors to better capture information. Coincentally, this leaves a lot room for exploration.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

N/A

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Collaborate with international companies and government parties would certainly make the UK presence more pronounce.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

US, Canada to some extent and China I would say is an interesting player.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	38 Degrees
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
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Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No comments

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

No comments

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

No comments

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Background:
38 Degrees uses geospatial data to determine a persons local council and their elected representatives, in order for members of the public to raise issues of local or national importance with the relevant representatives, councillors, etc.

This relies on data which maps postcodes to areas, such as a Westminster Parliament Constituency or a Local Council Ward. This can be achieved in multiple ways. The simplest is using an existing dataset which maps postcode to different areas / boundaries. However, many postcodes actually straddle political boundaries. Ie. not all households within a single postcode will necessarily be part of the same political or administrative boundaries – a single postcode may have some households in one Westminster Parliamentary Constituency, and some households in another, or some households in one local council and some in another local council.

Therefore a more accurate method would be to calculate which geographical area boundaries each postcode overlaps with to determine whether a specific postcode is straddles any boundaries, and if it does request the full address from the user in order to get an exact location for their household.

Challenges to access and suggested improvements:
1 – Distribution of data
Simple postcode mapping data is available from the ONS Open Geography Portal (http://geoportal.statistics.gov.uk/datasets?q=Latest_Postcodes&sort=name), however it is made available through a periodic CSV download. It is a manual process to monitor when a new version will become available, download the latest

version, and update systems which are based on this data. A more scalable approach would be to make this data available via a API (Application Programming Interface) such that organisations relying on the data can write systems which periodically check for new data, and automatically update their data with no need for human intervention. Some data is already made available via API (http://statistics.data.gov.uk/) however the datasets are limited and seem out of date having not been updated since 2017. Similarly Ordnance Survey has a number of products, both free and licensed, most of which are made available as periodic CSV downloads. Again this is not an ideal distribution method as it is very challenging to build a system which can automatically update itself with new data when it becomes available.

2 – Availability and licensing of data
The datasets required to provide members of the public with a more accurate system for finding and contacting their elected representatives are available, however they are not open or free (even for non-commercial use), meaning not-for-profit and civil society organisations are often unable to afford to use these datasets. Datasets which would enable this functionality include:

- Ordnance Survey Code Point (https://www.ordnancesurvey.co.uk/business-and-government/products/code-point.html) - this includes an open version, but the open version does not include the geographic polygons of postcodes which are available in the licensed version, and would be required to detect which postcodes straddle boundaries.

- Ordnance Survey Address Base (https://www.ordnancesurvey.co.uk/business-and-government/products/addressbase.html) - all versions require paid licenses. This data would allow the exact location of a users address to be found, which would be necessary if they lived in a postcode which straddled multiple boundaries.

- Ordnance Survey Boundary Line (https://www.ordnancesurvey.co.uk/business-and-government/products/boundaryline.html) - this is already open and free under the Open Government License (OGL). This includes geographical boundaries for all political and administrative geographies.

Why this would be of value:
If these datasets were to be made available freely under an Open Government License, using an API which could be automatically queried periodically for changes, then it would allow civil society organisations such as 38 Degrees and others to much more easily build and maintain systems which allow members of the public to be put in touch with the relevant representatives to make these representatives aware of issues of local and national importance which matter to those they represent. This would have the effect of increasing democratic engagement and accountability of elected officials.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

No comments

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No comments

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No comments

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No comments

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

No comments

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No comments

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

No comments

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There are challenges with inconsistent methods of obtaining the data – for example, some data is available through APIs (Application Programming Interfaces) and datasets can therefore be automatically updated when data changes. However, many other data sets must be manually downloaded as CSV files and then these CSV files manually uploaded into systems. Making datasets available as both CSV and via APIs would greatly increase the potential for organisations to automate their data flows, so their data is more up-to-date and less prone to errors creeping in through human error.

There are also challenges with consistent naming of areas / boundaries. While the majority of datasets refer to areas using the ONS / GSS Coding System (https://en.wikipedia.org/wiki/ONS_coding_system), some do not, and this is problematic because it means data from different datasets cannot always be easily matched up. A more standardised manner of identifying geographic areas could greatly increase automation within organisations, meaning fewer manual and potentially error-prone steps are required to process geospatial data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No comments

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comments

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No comments

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No comments

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No comments

Q18: Are there any other areas that we should look at as a priority?

Democratic engagement and access to public services.

With increasing calls for further devolution of powers to regions, city mayors and other local bodies, it is increasingly challenging to know who is responsible for delivering different services, and which authorities need to be informed if something is not working correctly – something which is already complex, as can be seen in this diagram made available on the ONS Open Geography Portal (https://www.arcgis.com/sharing/rest/content/items/90e1471cdd9e414d95b4aff9f761d12d/data).

In order to accurately know which body a member of the public should get in touch with requires a combination of detailed knowledge of administrative and electoral boundaries, as well as detailed knowledge of which bodies within each

local area are responsible for different services. The data of which bodies hold responsibility for different services in different localities is currently lacking.

Other examples of data which could increase democratic engagement would be geographic data on location of polling booths during elections and which households must vote at which polling booths. Something as simple sounding as directing people to their local polling booth is actually extremely difficult given the current publicly available data, and services which provide this information quickly and simply to the public has the potential to increase turnout and engagement in the political process.

Access and awareness of public services could also be increased by making more data available about the location of these services – for example, being able to easily identify your closest GP surgery, pharmacy, NHS dentist, walk-in centre, A&E, etc would all allow a valuable service to be provided by third parties. A similar example in a different sector is CityMapper which makes use of open transport data. Making the locations of public services available, and the types of services they currently provide, could enable greater public awareness and improved utilisation. It could also enable greater public scrutiny and transparency about provision of local services, and provide a valuable tool for analysing provision of services by councils themselves and charities / NGOs.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comments

Q20: How best can we make the UK's presence in the international geospatial world more visible?

No comments

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comments

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	77m Limited
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

In this innovative sector you have taken a far too restrictive view of what is wanted. The overall issue is not necessarily the scope of geo spatial data but the open licencing of data overall and the quality of what is available. If businesses can use data commercially with no fear of 3rd party future licencing restrictions or licence changes then if the data isn't all high quality they will still invest in making it better. What is required is a far more laissez-faire attitude where the industry can evolve along lines not even considered. The role of government should be limited to just producing a very flexible structure, one that involves OGLv4.0 not v3.0.ie Fully Open and verified against 3rd party rights in advance. The executive summary also assumes a too rigid and structured approach. Let the industry decide delivery methods but raw full data supplies may be much quicker to implement for example. APIs will not be wanted by all. If we must rely on Govt to implement and run for example additional delivery services it will inevitably slow down initial access to data and slow down updates and hence delay all financial benefits from releasing this data. Some times the basic delivery means are adequate. Ie full data downloads rather than piecemeal "on-the-fly" delivery.
In this way revenue generation will go at the pace of the private business not be limited by the speed of govt. The executive summary makes too many assumptions, a lot of which will likely turn out to be incorrect plus it is trying to control and plan, which is the not the role of government. For the strategy to over achieve, opportunities must be driven by the private sector and all that is required is freely available access to the widest set of raw information possessed by all

organs of government.

Against each of your specific queries below I have added an potential revenue feature, to illustrate what we believe would transpire per annum and this is denoted by the initials AR –Additional Revenue. The size of the figures quoted will also indicate the degree of importance in most instances.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Releasing as many raw datasets under OGL v4.0 as possible. I have attached this new licence so it can be reviewed and rapidly implemented. When the GC meets, its first priority must be to recommend what datasets should immediately be released and/or the current licences need to be clarified to ensure no risk to businesses wanting to use the data in products. A classic quick win is that the HMLR Inspire polygon dataset alongside its Scottish equivalent should be immediately amended and this entails zero cost, as the delivery systems already exist and the T & Cs can be amended overnight.
The Govt expect to create £6bn - £11bn of benefit, so it makes sense the opportunities need to start this year and not wait for 6 months. Businesses afterall need time to develop solutions and cleanse poor data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Additional personnel but these can be easily recruited as long as the raw data is available so income can be generated to pay for them. This can either be in the form of full time employyes and/or self employed contractors. Further teaching capacity maybe required in the medium term but at he present time there is sufficient capacity for the 1st development phase. Government should probably plan to teaching double capacity by 2025, if this intiative fully bears fruit. Otherwise how else will upt o £11bn of benefit be delivered?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- HMLR Inspire polygon dataset date already available, just amended. OGLv4.0 licence required. AR - £50m-100m
- An HMLR Title No/Inspire No is not released but is available internally within the HMLR now. AR - £100m - £200m. **This a vital component in unlocking the land and property area valued at £1.5bn**
- UPRN/UDPRN look up table currently internally available withn the ONS but not released. AR £50m - £100m
- Expanding and improving Codepoint Open. Whilst the AR would only be in the region of £2m - £5m, this is an important element in the land and property sector. The improvements required are monthly rather than quarterly upating plus including the coordinates for the Not Yet Built postcodes
- Returning the VOA NDR dataset back to an OGL licensing status that prevailed prior 31/03/2017. AR - £5m - £10m
- HMLR lease data – not released but available internally now. AR - £100m plus
- The main question what is beng released under “Open Mastermap” & this needs to be urgently addressed in the 1st session of the GC and the following definitve answers should be publicly released:

    - What is the exact daily threshold limit being proposed anything < 10,000 per company would stifle innovation. Why limit any way? This doesn’t help business. What about where solutions need UK coverage to work? Are they expected to download data for years??
    - Does this cover both the Topo and ITM layers?
    - The exact definition of a small company. Assume this means the company using the data to make products and NOT the customer else small businesses will not be able to sell to most of the market.
    - The minimum spatial extent should be 1 square km or products will be hugely stifled and £11bn will never be achieved.
    - We note that the OS say it is not being released under OGL why? This makes no sense as it will be expensive to police and again businesses just wont use data they cant be sure of.

- We would suggest there is a 2nd priority of data releases that can be dealt with after the above has been released or else govt will be swamped with data management issues. Again focus on whats there now and is cheap/free to release straight away.

- The Council tax listing that currently is embargoed under the Heseltine1991 letter. AR - £10m - £20m

- HSE data see question 14

- All EPC data that currently not available . AR £5m - £10m

- Current EA Landfill data, currently available under a commercial licence unlike historic data which is OGL AR £2m -£5m

- HMLR Day list – AR - £20m - £50m

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

What is urgently required is a far more accurate address listing than currently provided by the Royal Mail. 77m ltd already has the solution that could be rapidly implemented to fill this gap in the data industry.

The evidence for this is that PAF only details addresses where mail is deliverable and takes no account of non-deliverable addresses and any “land” usage e.g.not addressing storage facilties and numerous other infrastructure features

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

By commissioning a rolling programme of updates on a consortium basis i.e. no involvement from government. There is no reason why this consortium should not be based on the current private sector providers with the provision that a subsidy maybe required to fly remote areas. This can be balanced by closing down the OS current flying operations and using the monies in this manner.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Fundamentally the Commission should leave this area to the private sector and not waste its energies on trying to 2nd guess what is required.Have regular sessions “one-on-one” with interested businesses to listen to new ideas and concepts and simply prioritise the best ones.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Let the market decide based on supply & demand. Crystal ball gazing is futile because if you believed the predictions of the 1950’s then nuclear energy would be providing free electricity for all and we would all be driving flying cars!.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The only task should be to improve the raw data quality released i.e purely a service provider and nothing else. This will also be the cheapest and quickest solution. Afterall it is no good these benefits occurring after a change of govt.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

This question is again trying to 2nd guess and this looks it has been produced by the Ordnance Survey. This approach is not appropriate for the 21st century. In the case of indoor positioning this is problematic because of the law of trepass and therefore should a low priority, and can only really be considered for publicly owned assets, unless the law changes.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

This is key. Private sector are literally sitting on thousands of high revenue opportunities that have not been launched because either the data is disparate, fragmented, inaccurate or most importantly not openly licenced.
77m has spent 7 years reviewing, automatically and manually fixing poor govt data and building a framework which allows any govt data to be linked with other govt data and now also any commercial data. This synergistic solution creates value for products which previously couldn't be predicted because the data couldn't be linked.
It would be a very useful exercise to take the Boston Consulting Group Report and sit down with key industry figures and business and test the assumptions. We would be happy to provide input.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The main challenges are access issues and the attitude prevailing from many civil servants that still consider that data should not be openly released. For example, there is current evidence that they are using the new GDPR regulations to prevent access to data that in fact has no personal information. It seems control of their empires is more important to these individuals than creating new value elsewhere. It would appear that taxpayers money is somehow not real money…This must be changed and a truly independent body needs to be established where the presumption is to release the data for reuse.. The majority of the panel members should come from the private sector.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission must have power to implement change. If every option can be questioned by the very organisations who will lose power if it is implemented then you can guarantee nothing will ever be achieved.
Certain govt organisationswill doubt every opportunity and create a culture of "analysis paralysis" stifling any innovation.
The GC must be given authority to achieve £11bn of benefit.
If every decision can be refused, appealed, reviewed, appealed, then difficult change and hence improvement will never occur.
What we have at the moment is poor, so the next 12 months should focus on hard decisions and the low hanging fruit.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

All health and safety information from the HSE. This should not be limited to geo-spatial data. AR - £5m-10m

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Let the private sector decide but a structured framework should apply i.e. no local authority should have the ability to withhold any non-personal data and ideally there should be a central depository, so all raw data can be accessed with 2 clicks. The current data.gov.uk web site is a mess and a simple delivery structure is required.
Back to basics re delivery is needed. Small companies would even pay to have data put on external hard drives (covering cost of time and drives) if that meant they could have data next week rather than next year.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

With the exception of natural resources all the other 4 as are of equal importance. Access to the specific datasets and liberating the licensing regime will solve most issues.

We thInk it is also worth noting that the data quality of many of the current releases leaves a lot to be desired and rather than working on schemas and APIs etal, a high degree of effort should be put into improving the base data and ensuring legacy data is released where it exists.

77m would consider supplying (for a fee) data already cleansed.

Q17: Are there any other areas that we should look at as a priority?

- Release the HMLR Inspire polygon dataset from restrictive licensing now
- Release the Title number/Inspire ID look up table
- Release the UPRN/UDPRN look up table
- Both 2 & 3 above are fully discussed in question 4

Given that the GC wll sit for 2 years it important that agreed actions are released for sign off, every month, and in this way, the economic bnefits can accrue sooner rather than later

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

It is not so much the regulatory challenges but both the need for one simple licensing approach that covers all datasets and the need to change the attitude to not releasing data that is strongly present within the publc sector at the moment that needs addressing.

For private businesses to switch to new opportunities needs faith. Why lose current income for a “hope” that data can be used.
Afterall we have examples where “open data” was “retrospectively” changed to prevent commercial reuse.

Q19: How best can we make the UK’s presence in the international geospatial world more visible?

This is low prioriy and can be addressed in 12-24 months time, as the GC should not be distracted.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Given the complexity of the UK Data it is diffilcult to see who can help though software solutions developed in other countries. What could be achieved in the UK however could be rolled out as best practice elsewhere.

Again if we spend too long analysing what everyone else is doing or not doing we will be missing immediate and large opportunities.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	AccuCities Ltd.
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I cannot comment on country-wide GIS datasets but 3D models of as-built environments as used by Architects, Developers and Planners are often in non-gis formats such as CAD, MAX, SKP or Revit. These datasets are commercial datasets but used every day and while being usually available and country and industry is well served, they do have associated cost which can be prohibitive to new entrants. Revit / BIM models of individual buildings could be used to build CityBIM models.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

N/A

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

N/A

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Cycling lanes and Cycling docking stations - difficult to source
Air Quality Data - difficult to source simple maps with Averaged Data

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

N/A

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

N/A

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

N/A

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

High Detail / High Accuracy 3D Models of Cities can benefit many technologies, from 5G planning and management to autonomous cars, location based AR, VR, drone navigation and crash landing sites.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

I think that similar to London Busses, public sector organisations / OS should develop a set of requirements which could be followed by private organisations which can then deliver / sublicence their datasets to these organisations to make access easier.

Building-specific BIM models could be understood as GeoSpacial data assets, collected by public sector and make into CityBIM models.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

N/A

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

I think private sector should be able to deliver geospatial assets (3D City models, Planning Applications 3D models, BIM models and similar) back to OS or similar organisation against a grant / sublicense / reseller agreement.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We use London Datastore. While various data is available and it is appreciated, there is for various understandable reasons easy to work with single format. We are able to project PETAL ratings onto our 3D city model https://www.accucities.com/wp-content/uploads/AccuCities-Random-01.jpg, but various other maps and datasets (Surface flooding, cycling lanes, bicycle docking stations, air quality) are not in the format we could use like this.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By creating a centralised datastore for geospacial and georeferenced data and by releasing a clear set of guidelines for data to be purchased into this datastore.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Of course I think that having an access to 3D city models like those our company provide would benefit the wider industry - our models are used by commercial organisations daily. I think there is a large space between free models to everyone and commercial models only which might function as a barriers to entry. Speaking on behalf of AccuCities, we would for example be happy to discuss any form of sub-licencing (only to OS government licensees? to GeoVation companies?) or even making parts of our 3D model in lower detail / lower accuracy available through London datastore or similar. Our data capture however isn't accidental and we have to develop these datasets, therefore a way to recognise/recoup our expenses / loss of business from these activities should be assisted with.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

By creation of (fairly loose) standards that ensure reliability and usability by existing industries while allowing for future tech developments and regional variations. Adhering to these standards should allow private companies to sell back to central (government, OS or similar) database their assets for a sum that should be both high enough to encourage adherence yet low enough to ensure value for money.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

N/A

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Future Skyline developed in areas of high density development schemes together with existing / developed 3D city models would immensely help in infrastructure and construction industries.

Collecting BIM models and creating unified CityBIM model could help in infrastructure and construction industries but also in all kinds of SmartCity activities, including energy balancing, traffic and pollution management and many others.

Q18: Are there any other areas that we should look at as a priority?

Mobility: Planning and Traffic management of fleets of autonomous shared venihles. Volumes, choke points, where people work, recreate, shop and sleep and where vehicles should charge.

Mobility / Infrastructure: Developmet and Management of safer, city-enabled drones. Accurate and detailed 3D models could identify safest routes, roads crossing coordinated with vehicle traffic management, disused underground tunnels use.

Property and Land: Roof space potential valuations / development potentials.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

N/A

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By releasing set of state of the art datasets and databases, even for small areas of UK cities where new tech can be tested as a geo-located test bed can ensure testing and roll-out of new tech in the UK.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Singapore Land Authority is creating a state of the art 3D model of entire Singapore which should be the gold standard 3D Model with City BIM capabilities. The model will be detailed, accurate and updated, with the aim to service many industries including being a test bed for new technologies. Having this kind of model for cities would be hugely useful, however it is not a silver bullet serving all industries and has a price tag to match - $100,000 / km sq for some 65 square kilometers (M25 corridor around London alone is 1,600 km sq).

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	AddressCloud Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial data, Positional data and Geospatial Identifiers are accurate data types. However, it is noted that Geospatial services is quite a broad classification, and risks exclusion or confusion around services which are non-spatial, but built on geospatial data. Our view is that the public sector should focus on continuing to build high quality data and concentrate on making this accessible by private sector companies and developers rather than attempting to build and run consumer or business facing services.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Assist higher-education and representative bodies in creating and accrediting career pathways for software engineers which have a core in geospatial data and applications. While current accreditations (e.g. CGeog, MRICS) are focused towards the analytical, technical and professional skills of geographers, future geospatial data creation and application will increasingly be performed by engineers from outside the geospatial industry. Business would benefit from support in assisting non-spatial software developers and engineers in building careers in the geospatial sector. Secondly, there are limited high-education opportunities in the UK for software engineers wishing to focus on geospatial data

and applications.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Software engineers and data-scientists who can work on the entire geospatial "stack". Specifically, developers who can contribute to the entire life-cycle of geospatial data and application development, from creation, to consumption, analysis and storage of geospatial data.

For existing engineers, provision of a continuing professional development programmes that are not "GIS" focused but instead oriented around geospatial data and software development.

We cite as an example the Ordnance Survey Geovation workshops, which aim to make the latest developments in Ordnance Survey data accessible to the software community (https://geovation.uk/os-open-zoomstack-workshops/).

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Our core business is to provide information to our customers (primarily but not exclusively insurers) to help make better decisions. Our services fall into two main groups: addressing and location intelligence. We have grouped the challenges below accordingly:

Addressing

- OS AddressBase Premium - high quality dataset, however significant gaps remain against Royal Mail PAF data and timeline for new builds to appear remains a challenge
- OS AddressBase Islands - good step forward, however no transactional, small business licence available, only available to very large customers
- UPRN - supposedly open but requires a commercial licence to match address to UPRN, very confusing for businesses and general public alike

Location Intelligence

- Postcodes - CodePoint Open is a great product but does not cover Northern Ireland which is a significant challenge. Additionally, CodePoint polygons are very expensive and should be open. Price point means that this data is inaccessible for the majority of customers and so workarounds

are commonplace (buffer points, reverse engineer boundaries etc)
- Council Tax bands by address - key for insurers as a mandatory requirement for ceding risks to the FloodRe program (another government initiative). Not currently open or readily available commercially despite there being a public lookup facility
- Cadastral data - important for understanding risk to properties. Open Map Local shows generalised building outlines but these are too broad for many use cases with terrace houses for example appearing as a single outline. Open INSPIRE polygons available but OS terms exclude commercial use.
- Energy Performance Certificate (EPC) data available but has not been updated since 2016. Should be updated quarterly.

All of the datasets above should be keyed by UPRN so we have a consistent reference point. We have processed the raw addresses for every location in the land registry price paid and EPC data cleansing manually captured addresses and would be happy to support this initiative.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The Ordnance Survey AddressBase product suite is very comprehensive however pricing of these datasets is a huge barrier to entry for all but the largest of organisations. As an Ordnance Survey partner with a core business built on these products we face constant challenges from customers on the cost of this data. We work with a range of organisations from small startups to FTSE 100 companies, even some of our largest customers struggle to justify the significant price tag for this data. For medium sized customers the only viable option for licensing this data is on a transactional basis which makes forecasting usage and cost very difficult and when compared to geocoding services from global search engines (e.g. Google and Bing) we cannot compete.

Our recommendation would be to simplify the products to a single address product which is easier for customers to use. Customers can then choose the aspects of the product which best suit their needs. The product should ideally be completely open which would allow partners and developers to focus on building innovative solutions to real problems.

If this data cannot be made open then the licensing model requires a complete overhaul. The current model is very antiquated and is largely built around the concept of desktop users. With per user pricing starting at 5 figures and per organisation pricing 6 figures this is just not economically viable. There should instead be a simple transactional model where users are only charged a fair price for a matched address. For organisations who wish to licence the data for unlimited use there should be competitive tiered pricing based on the organisation size.

With regards to future challenges for emerging technologies requiring address data some examples are as follows:

- Self-driving cars (adress based routing)
- Micro-grids/on-site energy generation and distributed energy grids
- Fibre internet to premises (residential and commercial)
- Climate-based insurance (high-resolution risk models)

Whilst the AddressBase products are very detailed they are currently built around a 2D model and there is no concept of a Z value or building height which would be required to support the above future use cases.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Establish a common data-portal for Earth observation data, for both commercial and research purposes. Enable providers of imagery to easily provision access to their data through this portal, including for commercial uses. In particular, consider multiple scales of imagery and data may be supported in one location, for example aerial photos from drones, Lidar data from aircraft and imagery from satellite that cover the UK could all be made available at one location.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Embrace public cloud platforms to simplify distribution of data. For example, the AWS Public Dataset Program https://aws.amazon.com/opendata/public-datasets/

Continue to adopt open standards for files for example using the OGC GeoPackage format as opposed to proprietary formats such as ESRI shapefiles and file geodatabases.

Extend the OS example of distributing curated, ready to use data such as vector tiles (OS Open Zoomstack) to other datasets such as VML and Mastermap and to other agencies such as the BGS, EA and Land Registry.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Understanding location will be key for the delivery of future digital and physical services. It is clear that precise address information, curated from a range of linked data-sets (see Question 4), will be critical for future transportation strategies in both the private and public sector; for example self-driving cars will need to match physical location with address information for routing. In the financial and insurance sector, cadastral-scale information will increasingly be required for proper assessments of risk to property and residents, required by innovative social-fintech and blockchain applications, currently being developed in response to increasingly extreme flood, storm and heatwave events.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

(a) Where not in-place already, establish partner networks to enable business to use data-sets to create commercial services and/or become resellers of public sector data (similar to existing OS model).

(b) Reduce public sector provision of commercial geospatial services, and instead focus on better provision of access to data that can be more effectively exploited by the private sector. Specifically, reduce the requirements for physical media (e.g. OS Mastermap and Vector Map Local are still distributed by DVD - most modern computers do not even included DVD readers!) and focus on adoption of new technologies to provide effective digital storage and access.

(c) Continue to adopt and invest in use of new and open data-standards. For example the modern Vector-tile and Cloud Oriented GeoTiff formats could be used to help address some of the challenges around data-provision which previously required physical media.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Specifically related to software and data infrastructure, the Commission would do well to find ways for the UK to support the Free and Open Source Software Software (FOSS) that underpins much of our global back-end GIS data infrastructure (https://www.osgeo.org/projects/) in both the private and public sectors. It is these tools that have enabled a number of disruptive innovations to take place in the geospatial data-space (see Question 20), however these projects are not always directly funded. A parallel can be drawn to the non-spatial Core Infrastructure Initiative (https://www.coreinfrastructure.org/).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Our view is that the public sector agencies should focus on building high quality datasets and let the private sector build services on this data that are tailored around the needs of our customers. The public sector agencies should work closely with private sector companies to improve the delivery and format of the data.

The recent Open Zoomstack initiative from the Ordnance Survey is a perfect example of this. The OS delivered the entire suite of open mapping products as a single file with recommendations on best practices for styling the data. As a service provider we were able to download this file, apply the recommendations and significantly improve the quality of base maps for our customers. Feedback from the customers was excellent, we did not charge for this upgrade as our insurance customers see maps and addresses as "hygiene factors".

We see this kind of collaboration as a perfect example of the public and private sector working together. We believe that this approach will provide better value for the taxpayer than having the public sector build and run services. Running a 24/7 critical service in the cloud requires specialist skills which are best handled by private organisations. A cloud-based approach can also support improved data discovery and access for commercial uses, particularly of near-real time or frequently changing data. Increased exposure and accessibility of data-sets can help increase private sector use and associated royalties from public-datasets (see Question 21).

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The most significant challenge faced when using data from the public sector is the disparate number of locations where data are available. A single point of access for geospatial public data would greatly enhance the ability of the private sector to make commercial use of large volumes of existing public sector data.

Furthermore, such an initiative should be underpinned by a common distribution contract and a clear, concise and consistent set of end user terms (see Royal Mail PAF as a great example of this). Even across the Commission's Partner Bodies we have to adhere to multiple terms of service around data access for different customers. Simplifing this would reduce business overheads of using the data.

From a technical perspective, the public sector should continue to embrace the distribution of its data in modern, standards compliant, open data formats for easy data consumption.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The G-Cloud program is a great vehicle for SMEs however the onboarding process remains extremely complex and is a significant barrier to entry for small organisations such as ours. If the Geospatial Commission could work with the wider government to simplify this process and ideally have a specific track for geospatial companies this would greatly reduce the burden of selling to central and local government.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

N/A

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Enable the geospatial commission to empower one of its Partner Bodies to support collection of localised and regional data from public sector to create national data-sets.

For example, there is currently no simple means for standardising geographic information collected at the local authority level (e.g. planning) centrally. The Commission could look to support a centralised store for this public data.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

N/A

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We believe that the geospatial commission should focus on the making high quality geospatial data accessible and allow the private sector and individual developers to identify use cases and innovative solutions that use this data.

Q18: Are there any other areas that we should look at as a priority?

N/A

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

N/A

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Encourage the Commission's Partner Bodies to support and engage with industry-standards organisations, such as the Open Geospatial Consortium (OGC). In particular, it should be recognised that recent innovations in the Free and Open Source Software (FOSS) for geospatial have enable a number of disruptive companies to gain a significant foothold in the geospatial market (e.g. Mapbox, Carto etc.) who offer Software As A Service (SaaS) models. Supporting the underlying geospatial software infrastructure, in addition to support open data project, would help UK business become leaders in geospatial software and services development.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Two interesting examples from the United States include the US Geological Survey which acts as a centralised portal for remote sensing information collected by NASA, as well as other terrestrial data-sets covering a wide variety of data-types and use cases (https://www.usgs.gov/products/data-and-tools/gis-data).

Second, the commission may additionally benefit from NASAs current experiment in using Amazon Web Services for data storage, which not only assists NASA in dealing with significantly large data-sets but enables researchers and industry to better access data products (https://www.nasa.gov/press/2013/november/nasa-brings-earth-science-big-data-to-the-cloud-with-amazon-web-services/). This is the largest-scale example of private industry cloud hosting for public data.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Association of Geotechnical and Geoenvironmental Specialists (AGS)
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definitions emphasis on 'place' tends to suggest earth surface location in a 2-dimensional sense. The recognition of data relating to a 3-dimensional location should be more highlighted, e.g. for geological, oceanographical, atmospherical situations.

Geotechnical Data produced by ground investigations for engineering projects contains a wide range of parameters. It is relevant to a wide range of disciplines including ground engineering, geology, hydrogeology environmental geology and near surface ground resources. Data is collected in 3D, otherwise it has no value to the project.

The data is national and should be placed in space as x, y and z in the ground (in 3D). The production, collection and density of data depends on infrastructure development/projects as ground investigation data is used to inform suitable, efficient design and construction of elements in the ground.

The data has high national value as the methods to produce the parameter data collected uses national or international Standards.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Graduates in engineering and geological disciplines do not yet understand the basic concepts of data, how it is collected, managed and processed. There is a need for universities to include some basic studies in this area.

Introduction to the geospatial concept should be included in technical university courses e.g. civil engineering, where these would be expected to be highly relevant for subsequent employment.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Data management and IT skills in isolation of perspective/understanding of the relevant application are not sufficient. Civil engineering requires high calibre numerate graduates with intuitive grasp of the data meaning as well as the ability to manage it in terms of collection, collation, validation, manipulation and expression.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Geotechnical/geological data is acquired from ground investigations which are normally associated with civil engineering construction projects. This is held by many different public organisations and private companies. Some of this data and information is donated to the British Geological Survey (BGS) who make some of it available via a web service. However, the data has historically been regarded largely as single use and much of it has remained within the project. This is due to the difficulties of easy recoverable storage, and the ownership/intellectual property rights regarded by the commissioning parties. The BGS does not provide all the information or data as it has been under confidentiality agreement or considered to be confidential.

Access to historical information is of immense benefit to private and public developers and other bodies for more efficient control of ground hazard and risks. This will lead to a reduction in ground related failures and significant decreases in delays and costs for both public and private projects.

Ref ICE manual of geotechnical engineering: 2012: Volume I. Chapter 7 Geotechnical risks and their context for the whole project

The BGS, currently provides only a small proportions of the data as scanned borehole logs. This is a free, easily accessed web service. However, nearly a quarter of the borehole scans are not generally available because of concerns about historical confidentiality and ownership. There are considerable concerns

about liability, confidentiality, copyright etc. of the data which prevent owners of the data form making it available.

For many users it would be more efficient if instead of information (borehole log scan) that the data itself is made available. This is relatively simple to provide if final ground investigation project data, available as industry standard data transfer format, so-called “AGS data”, was provided as a matter of course to the BGS, who could then supply it more generally. However, there still remains the questions regarding ‘confidentiality’ and ownership.

If the data were “issued” with an open source licence, such as the government one, then the data could be made available to all with no concerns about liability.

There is a historic division in the industry between what has been called the ‘factual report’ and the interpretative report. It is the data, as defined in BS8574, which can be provided as ‘AGS data’ files. The ‘AGS data’ files should be made available and the so-called ‘factual’ report, which also contains the data and information about the tests etc., effectively the metadata, could also be made available. The reports which contain evaluated, interpreted, or other processed data can still be of restricted circulation.

To show best practice, the ground investigation data from all central and local publically funded infrastructure schemes should be provided to the BGS as open data, preferably as final AGS data files. This can then be provided by the BGS to the industry.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Data referencing is key in terms of defining a 3-dimensional location to which a piece of information applies. In a civil engineering context, the Postcode Address File (PAF) provides a general location for a project 'site' but individual elements are located using a survey system based on National Grid coordinates (OSGB36) and/or global geodetic system (e.g. WGS84) or other location system. Ensuring consistency of systems and accurate transformation between systems is essential. Some local grids are still used, such as London grid, as this was used by some (London Underground) and pre-dates BNG. Project grids are also used. There is also the requirement for the means to define positions that are time dependent, e.g. structural or geological elements undergoing displacement due to applied loadings, geological processes, ground water levels etc.

A Geotechnical data dictionary already exists, this will need to be enlarged and enhanced with time as technologies change.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

GIS needs to be considered holistically so that seemingly disparate disciplines and technologies can be incorporated where beneficial.

Support, enlarge and develop the BGS's ability to obtain and provide ground investigation data to third parties as data (such as AGS data format) and information (borehole data base). Greatly reduce the problems of provision due to 'confidentiality'.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

In a civil engineering construction context: collection, collation and modelling of performance monitoring data, i.e. information relating to structures etc. and how they have actually behaved compared to the information used at design stage to predict behaviour, and rationalization of the differences.

Unification of data transfer formats to enable data sharing. Currently, the UK has the world leading transfer format ('AGS data').

Development of machine learning modelling so that data can be used intelligently rather than just repeated reanalysis by users of the same source information. New data acquired should be added to develop the ground model, both in terms of additional information and update of changes. Users should be able to access the model rather than the just data.

Mobile apps for collection, processing, and use of data.

Easy availability of relevant data from whatever source or limited number of data suppliers.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The civil engineering industry already has a ground investigation data transfer format ('AGS data') working on BIM (a government initiative), a sensible tie in to geospacial data is required. However, BIM commonly neglects the ground providing only data, information and modelling of the structure. The ground is usually the main unknown.

A number of initiatives are underway, but some of which may not be heading in the right direction as the input from ground engineering or geology has not been included or has been too limited.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

All public sector final project data should be made available as soon as possible; a clause in public contracts requiring the data to be made available with an Open Source Licence could be implemented. This data could be managed and provided by an organisation such as the BGS. A rapid increase in data, as is hoped for, would require investment in the BGS to allow a freer, more relevant (provision of data by area rather than by project) flow of data to the industry.

Secondly, it could be made a requirement of all planning applications that the geotechnical and geoenvironmental data and information for the project should also be made available with an open source licence, and preferably supplied to the BGS.

Lastly, all public sector projects (perhaps above a certain threshold value) should use 'AGS data' format. This will improve the efficiency of the project in the short term, i.e. design and construction, and ease the use of data for maintenance of the construction and future projects and services.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Simple methods of accurately locating the position of ground investigation points are essential. In particular, elevation accuracy of less than 10 cm are often required. Accurate coverage is required in urban and rural areas.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector organisations should be obliged to collect and deposit data to a national asset (BGS for ground investigation data). This requires standards defining the data type and format to be acquired in particular situations, (currently primarily 'AGS data' format as well as clarity regarding liability, intellectual property and copyright.

Private development commissions a significant number of the ground investigations in the UK and little of this is made available to the wider industry. A way of encouraging/requiring the sharing of data would be beneficial to all.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

A particular case for the civil engineering construction industry is the lack of availability of previous ground investigation information and data for early project planning, desk study and identification of ground risks at an early stage. This can lead to increased costs and programme overruns during construction projects due to 'unforeseen' ground conditions are common.

Ground investigation data from some parts of the public sector are not provided to the BGS. The data should be the final version and should be checked for the accuracy of the data and that it follows the rules of the data format. It can then be released to the public client. The public client is not always insistent on the quality of the final data file. The data file, with the 'factual' report can then be provided to the BGS to manage with permissions to provide it to third parties. This data could then be used for future projects. The storage at the BGS could provide a backup of the data into the future for the public client. It would be preferable if all the geospatial data was provided as National Grid References and the Ordnance Datum as well as local grids, if used. This would allow for easier access for other projects.

The use of this data in future projects would be used to more accurately identify ground risks at an early stage of the project. This would lead to more informative, better focused, cost-effective future ground investigations leading more efficient mitigation of ground risks during design and construction.

A requirement for sharing of ground investigation, construction and post-construction monitoring data could be included within relevant standards and specifications, e.g. BS 5930, ICE UK Ground Investigation Specification. However, this might require some government backing.

As mentioned elsewhere, clients, including public bodies, are reluctant to release their data. However, where the data has been made available there are standards, technologies and processes in place which enable proper and effective use of this data.

These included

BS 8574 Management of Geotechnical Data

AGS Geotechnical Data dictionary

AGS Electronic Transfer format for Geotechnical Data

BGS Borehole data base

BGS Geology App

BGS web services

A significant number of propriety computer applications, which enable collection, management and processing of data are available.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By promoting and requiring best practice as outlined in other question responses. The improvement of ground investigation data and information management within the public sector.

By promoting the processes that already exists, and by helping to remove the 'road block' of reluctance to release data, providing the data for 3rd party and information to the BGS. The BGS can then provide the data for infrastructure and other construction projects. Some web development might be required to make this more efficient.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

To aid the development of brownfield sites, the provision of previous land use as applicable to the assessment for development (such as in the DoE profiles). This should include any remediation that has been undertaken. This would improve the understanding of potential contamination, chemical and physical, in the ground identifying the potential financial risk of development at an early stage and improve uptake brownfield site development. The data/information should be freely available to developers and local authorities and potentially others. The data would be supplied in GIS suitable formats but other formats might also be required such as web services.

The data/information content required should be decided by data holders or potential data holders, developers, local and central government and their agencies and contaminated land specialists.

Records of historic mining activities held by the Coal Authority, for example, provide a powerful resource for minimising ground risks for new development. Access to this data should be available and incorporated into ground models.

Ground related construction information ('as built' as opposed to 'design intended') is another area, particularly for deep foundations (ie piles), where historic data provides valuable insight into both what is in the ground, and effectively full-scale construction trials.

Deficiencies in reliable underground utilites information present an everyday hazard for construction, eg gas, water, electricity, sewer, phone, broadband, cable TV, etc. Improved recording and access to data for these would lead to a considerable reduction in safety hazards and disruption to services.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Fostering cooperation between all parties, promoting the advantages to companies, agencies and government of the importance of data quality and data sharing. However, this might require appropriate legislation or changes to planning rules (i.e. a requirement of planning permission). It should already be considered a requirement of publically funded projects for the final data file to be provided to a central data manger, currently the BGS, for provision to the industry. A time delay on provision to third parties might be required in some cases or exclusion for highly sensitive projects.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Add a requirement for Geotechnical data to be made available to third parties at a specified time (after the completion of the ground investigation or after construction) via the planning process. Promote (require) the use of 'AGS data' as the project transfer format, possibly for projects larger than a certain value. Ensure that the data is of suitable quality (usually done by the lead contractor but the client must insist that this is done as part of the contract). Provision of the data to an organisation such as the BGS as the data managers and a central source for the data to the industry.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Collection of ground investigation and other geological data and information by the BGS relates strongly to the three high level themes and three of the five high-value categories. This has existed for some time but has considerably greater potential than has been realised. This has been limited by a combination of technological, legislative and legal issues – as responded to elsewhere. Although the technology exists, it is the legislative and legal issues that still hinder. The provision of all the ground investigation data might require further soft and hardware development and support.

Encourage the Highways England to provide the Highways Agency Geotechnical

Data Management System (HAGDMS) more widely available either through the portal or via the BGS.

Q18: Are there any other areas that we should look at as a priority?

See the response to Q14.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

BIM (a government initiative) is a major opportunity/concern. If it is developed in the right way it will be a major step forward. However, it should include suitable representation of the ground. It might be developed in the wrong direction and become a millstone by inflicting restrictions on the industry rather than enhancing.

There might need to be a regulatory requirement to make ground investigation data available to third parties.

Data is currently supplied to the BGS sometimes as a requirement of the client or as voluntary donations by industry.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Promotion of the benefits (financial, environmental, identification of risks, safety etc.) realised in the UK by the use of geospatial data. Cooperation and assistance (on a commercial basis and otherwise) with development in other countries. Consideration of national security required.

In 'The Geotechnical World' the UK leads the world in data transfer format. The BGS borehole data base has been copied elsewhere whilst the AGS Data Management document ("AGS data") has been adopted in more than 10 countries throughout the world. We should continue to promote these successes in the UK and elsewhere at every level, identify and promote best practice.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

From the AGS perspective, the UK would appear to be amongst the leaders in terms of managing ground investigation data and data transfer. The approach having been adopted by various other countries including Hong Kong, New Zealand, Singapore, some Australian States, Norway (offshore)

Ongoing review of developments around the world should be maintained to identify alternative potentially better methods.

Rather than look at others successes it is very enlightening to see where others have not been successful. There are a number of initiatives which have been less than successful, most of which fall into the 'trying to do too much too quickly' or are too simplistic. The UK system has been developed 'by the industry, for the industry' and is now in the enviable position of being "tried and tested innovation" . It just needs the road block of legal concerns to be negotiated.

Some countries require ground investigations for projects with certain requirements (such as piled foundations) to be provided to local or national government or their agencies including Cyprus, Singapore and Malaysia. This can then be used to inform planning, ground hazards and risks to current and development.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Airbus Defence and Space Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X (see below)**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

This response is being submitted by Airbus Defence and Space Ltd.

About Airbus

Airbus is a global leader in aerospace, defence, space and related services. This includes a 14,000-strong UK workforce spread over more than 25 UK sites, generating annual revenues close to £6bn+, making Airbus the second largest aerospace and defence employer in the UK and a major contributor to the UK economy.

Building on a proud 100-year British industrial heritage, Airbus is the largest UK commercial aerospace company and biggest civil aerospace exporter. Wings for all models of Airbus aircraft are designed in Filton near Bristol, and manufactured in Broughton, North Wales. Airbus's defence and space activities in Stevenage and Portsmouth make it the UK's largest space company and the world's leading commercial provider of military satellite communications.

Airbus Geo Intelligence

Airbus Intelligence is a company within a company, a team of 2000 professionals working globally acquiring, interpreting and delivering data, systems and services to 1000 Customers in 105 countries.

As the world understands the value of data, our remit and mandate has become more exciting and expansive.

The Intelligence programme line of Airbus Defence and Space is a recognised world leader in geo-information, successfully pooling unmatched access to earth observation satellite imagery, combined with unique expertise and decades of experience within one single operational organisation. Airbus delivers a broad portfolio spanning the entire geo-information value chain. These include data sales and customer service, data management, data analysis and analytics, data hosting and operations, platform and software development, integrated maintenance and delivery systems and consultancy services. The intelligence programme line of Airbus Defence and Space has offices in UK, France, Germany, Spain and Hungary and over 2000 staff.

The Intelligence programme line has a strong competence and long history of developing and implementing digital systems enabling the processing, management, quality assessment and archiving of large volumes of satellite Earth observation data, collected by both Airbus Group satellites and others, including providing services for ESA for over 25 years.

The strap line, delivering value from data in a digitally connected world, is far from a marketing buzz and genuinely daily business. In helping decision makers anticipate and respond to changes in their environment, we know that we have to co-develop tools to validate, accelerate, look after and secure data to strengthen the analysis and support the decision.

We invest in our Satellite data delivery to ensure continuity for our Customers, be it in Defence, Maritime, Energy, Agriculture, Forestry, Finance and for varying governmental and private organisations.

List of abbreviations used

ARD	Analysis-Ready Data
CEOS	Committee on Earth Observation Satellites
GEO	Group on Earth Observations
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
EO	Earth Observation
EOC	Earth Observation Committee
HAPS	High-Altitude Pseudo-Satellites
ISCF	Industrial Strategy Challenge Fund
NCEO	National Centre for Earth Observation
NERC	Natural Environment Research Council
OGC	Open Geospatial Consortium
R&D	Research and Development
SBAS	Satellite-Based Augmentation System Sentinel
SEDAS	Data Access System
STEM	Science, Technology, Engineering, Mathematics
STFC	Science and Technology Facilities Council
UKSA	United Kingdom Space Agency
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definitions of geospatial data, positional data, and geospatial identifiers is adiquate. However, we would suggest that "geospatial services" should rather be "geospatial *products and services*" or "geospatial intelligence products and services" as geospatial services is a rather vague term, and implies the derivation of products or services further up the value chain. The inclusion of satellite Earth Observation data in its different forms, including very high resolution video and still imagery from satellites, is of key importance and we believe the terms should also extend to data from high-altitude platforms (HAPS) and drones and in-situ networks of sensors such as traffic monitoring and air quality sensors. The definition should also extend to geo-located information from social media, mobile devices, news feeds, weather forecasts, climate models and similar.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission should focus on inspiring the next generation of geospatial and Earth observation data engineers and scientists from an early age. A programme of outreach into schools and universities to promote careers in this domain would be welcome, perhaps done in partnership with the UK Space Agency.
In addition, insertion of specific moduals focused on Geospatial data science and

Earth Observation into A level and below would mainstream these concepts and key skills into the next generation at a much earlier age.

Sponsorship of postgraduate courses and programmes that enable STEM graduates to acquire specific geospatial and Earth observation data handling and analysis skills would be valuable, as would sponsorship of industrial placements or apprenticeships in this field.

In particular, computer science graduates need to be skilled up in geospatial data processing, as many future apps will likely include a geospatial element; and in developing more user friendly interfaces to interact with geospatial data, to reduce the level of specialist skills and expertise needed in the end-user community to extract value from geospatial data.

In the mean time, there is also a need for education or reskilling of the end-users, particularly in the public sector, so that civil servants can make the best use of geospatial data in their departments and agencies.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Our organisation requires the availability of talented engineers and scientists with relevant geospatial data analysis skills. Key gaps include:

- Geospatial data scientists
- Geographical information system (GIS) experts
- Earth observation data analysts / data scientists
- Earth observation data processing engineers
- Experts in big data analytics and application of machine learning and artificial intelligence to geospatial data.
- Developers and software architects with geospatial data processing and applications development expertise
- Cloud computing skills

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The full value of Earth Observation data is only realised when analysed in conjunction with complementary public or private geospatial data sets. The UK

lacks a coordinated data access solution that can bring together such data sets and make them easily and operationally accessible to industry for exploitation. This includes for example existing governmental geospatial data such as from the Ordnance Survey, Hydrographic Office, British Geological Survey etc.

UK has invested piecemeal in various initiatives including UKSA investing in access to Copernicus Sentinel data via the SEDAS hub and STFC investing separately in the JASMIN facility which is predominantly for NERC use. None of these are suitable for full operational use (e.g. no out of hours support) as they are not operated on a commercial basis.

We would prefer to see the UK take a more holistic approach rather than investing piecemeal in disparate elements of a solution, and ensure that the infrastructures are designed and operated as **fully operational services meeting commercial service level standards** for big-data infrastructures. The Geospatial Commission can play a key role here in coordinating the UK national approach to this.

At the same time, we recognise that there would be a cost to government for making geospatial data easily and freely accessible, and the cost needs to be justified by the benefits. We would support an evidence-based approach to data release and management that would allow government to experiement with putting parts of data into the public domain for industry to exploit on a trial basis, before committing to the full cost of release and maintenance.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

As the resolution of of Earth observation data gets more precise and with future innovations such as video from satellite and HAP's the ability to accurately address locations will become more important in the development of applications from tese data types.

Applications where accurate address data is paramount is in the security sector, justice sector (offender tagging), insurance sector, financial and property sector and emergency/blue-light sector.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We would welcome a holistic approach to geospatial data access for the UK, which would bring together diverse satellite and terrestrial geospatial data sets along with the necessary storage and processing capacity, the tools to exploit the data, access to expertise and know-how, and the means to deliver resulting services to customers in the commercial and government sectors. These efforts should be joined up across the Geospatial Commission, the UK Space Agency (which is examining options for UK EO Data Access), the UK Space Sector Deal, and the ISCF Wave 3 "Space Data Revolution" challenge proposal, to enable an effective and coherent market for the UK.

The mechanisms for implementing such an approach should be investigated, i.e. commercial service procurement vs public investment in infrastructure, to better attract private investment and secure a sustainable, performant and continuously improving enabeling service capability upon which the UK EO sector can develop new applications, succeed and grow.

Another key role for the commission would be to organise and coordinate the UK government's needs for geospatial information – essentially acting as 'intelligent customer' for geospatial information services on behalf of the UK government. This would enable industry to act as 'intelligent supplier' investing in key areas to meet government needs. If geospatial services can be operationally proven at significant scale with UK government users, UK industry will be in an excellent position to export the same services to governmental customers globally.

We would also ask the Commission to strongly support the efforts being made within the UK Space Agency and DEXEU to ensure that the UK remains a full participant in the EU Copernicus programme post-Brexit. Operational access to the free and open data from Copernicus is in itself of value to the UK, but the ability to participate in industrial contracts and to have a say in the future direction of the programme would provide immense additional value, for example in delivering future EO data sets that meet UK policy needs and priorities.

The UK is the only large EU member state without its own sovereign EO satellite capabilities. Independently from whether the UK remains within the Copernicus programme, the UK should seriously assess its requirements, to invest in its own sovereign capability. The Geospatial commission can play a significant role in this analysis.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

If the UK continues to rely solely upon free and open data sources provided by Europe or other countries, we will never differentiate ourselves from any other nation vying for economic growth in this domain. We see the biggest potential for economic growth coming from the exploitation of near-real-time, very high resolution, global data which can unlock the insights that help business and governments to make better, more timely decisions. This needs to be coupled with integration of new technologies (big data analytics, artificial intelligence, machine learning, data mining etc.); and development of user-friendly access and interfaces (including visualisation and interaction tools) to maximise derived benefit from the data.

As such, we would encourage the commission to support the growth and evolution of the UK's capability to acquire and exploit its own very high resolution, near-real-time geospatial data sources, in particular focusing on technologies that give the UK a unique proposition – such as satellite video constellations, small radar constellations, thermal infrared sensors, hyperspectral sensors, HAP's and other evolving technologies that build on UK industrial and research strengths and can differentiate us. We do not mean that UK government must build such systems itself, but should rather create the conditions whereby the private sector is able to invest in such technology development, by being **an intelligent customer of the data or services**, helping to mitigate the risks, be they in technology development, market uptake or raising of venture capital.

Another key differentiator for the UK is its reputation and ability to deliver trusted data with known heritage in terms of quality and integrity, and this is an aspect of UK capability that can be supported and promoted by the Geospatial Commission.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications are already helping to transform many areas of industry and government, in areas such as in agriculture, transport, energy, conservation of natural resources, and responding to natural disasters. However there are many new applications of geospatial data that are yet to be conceived, for example in smart cities, smart energy, autonomous vehicles and more.

To support enhanced roll-out of future technologies, it is essential to make it easy for industry and researchers to access geospatial data and apply it in new areas of government and commerce. Geospatial data can also benefit from the application of new technologies such as AI and big data, 5G networks, etc.

It is also essential to invest in R&D of new applications and support the transition of that R&D in to demonstrations and onwards in to commercial applications. All future technology roll outs will need to have a geospatial component – EO needs

to be part of this, or the UK will get left behind.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Many public sector organisations in the UK invest in their own infrastructure to maintain their geospatial data sets. This includes commission partner bodies (UKHO, BGS, OS etc.) as well as others such as the Met Office, STFC, Defra, several universities, NERC research centres (such as BAS, NOC), the Satellite Applications Catapult and others.

This approach tends to result in 'stovepipes' of geospatial data dispersed around the country, each with different formats, standards, accessibility, licensing etc. The UK open data policy mandates public sector organisations to make all non-personal data available openly but each organisation is at a different stage of implementing this policy and it is particularly challenging for industry, academics or government bodies to access or even discover what data is available where. It also makes it difficult for all UK stakeholders (public and private) to exploit the synergies between these data sets.

Our preferred option would be for the commission to lead the way in establishing a common national mechanism for accessing geospatial data in which most if not all UK public sector organisations would be able to participate, adopting common standards, formats, interfaces, licences and data policies. This does not mean a common *physical* infrastructure: elements of the mechanism could still be hosted by different organisations, with focus on enabling interoperability and a common point and means of access for all UK stakeholders, public and private.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We fully expect to see an increase in the number of geospatial applications that combine the use of Earth Observation and positioning technologies and exploit the synergies between them. For example, surveying applications that use GPS/GNSS technologies could be augmented with superior knowledge of the local terrain and 3D environment derived from Earth Observation.

Underpinning technologies to be prioritised should therefore include

- Access to high integrity / high precision GPS/GNSS sginals post Brexit;

- Alternatives to Satelite-based Augmentation Systems (SBAS) e.g. for areas where SBAS does not work well, and/or for improved resilience;
- Security (for anti-jamming & anti-spoofing);
- Plus information technology and big data analytics technologies already mentioned (see Q7)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

In order to encourage and enable growth we would encourage UK public sector to source as much as possible of the development, maintenance and operations of the underpinning infrastructure from the private sector, preferafably as a service, ensuring checks and safeguards are in place to ensure that this infrastructure service is accessible to all UK stakeholders on a fair and equitable basis. If the capability exists in the private sector, and is cost-effective then it does not make sense to duplicate the capability in the public sector. Procuring from the private sector would encourage further private sector investment for the benefit of all.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Key issues include navigating and negotiating data access, even for publicly purchased or provided datasets. i.e. **discoverability and accessability.** Even data.gov.uk lists many datasets that cannot be systematically accessed, and there is no geospatially aware discovery mechanism. Public and private organisations need to be required and/or incentivised to make data publicly discoverable and accessible where possible, via standardised and easily accessible routes, note this does not automatically mean the data are free.

Understanding the sustainability, maintenance plan and quality for public data sets is also key in order to enable the private sector to invest in the production of products and services utilising these data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission can act as a more effective customer for geospatial data on behalf og the public sector by the following:

- Identifying current and future geospatial data requirements across all relevant government departments and agencies;
- Consolidating these and identifying areas of duplication or overlap, so that relevant geospatial data can be acquired once and used multiple times;
- Making the needs and requirements openly visible to industry, such that industry can plan its own investment and technology development to meet future public sector needs;
- Act as coordinating procurement agency on behalf of government, tendering for 'geospatial information as a service' with decent length contracts (e.g. 3-5 years) and associated operational service level and quality criteria;
- Ensure level playing field for large and small companies to respond to these procurements, and engage multiple providers to ensure diversity and resilience of data supply.
- Encouraging private sector innovation to drive forward the effective use of geospatial products and services within government.

This type of sophisticated approach would ensure value for money for UK government when procuring geospatial data/information services, whilst also encouraging UK industry to invest and ensure continuity of supply for future government needs.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There are potentially numerous. Examples include insurance claims, crime statistics, accidents (road, domestic, industrial), traffic, footfall, noise, air pollution, news feeds, social media, elevation data, information on public utilities/services, electoral and census data, public transport data feeds, CCTV etc. As this data is currently difficult to access and exploit, the potential applications and use cases have not even started to be explored. A specific challenge would be the significant commercial and privacy issues around some of these data sets – certain types of data would likely need to be aggregated and/or anonymised.

Satellite imagery procured for government use by one department should be available to others. There is currently no catalogue of imagery (that we know of)

that has been procured by UK gov (under related license agreements) that allows all government departments to discover and utilise. For future satellite imagery procurements we would suggest that they should be procured under a pan-government agreement to allow the data to be shared and accessed by all relevant departments – thus avoiding the duplication of data storage and license costs.

It goes without saying that adequate access to Copernicus data needs to be secured post BREXIT.

We believe that the public sector would also derive significant benefit in a number of areas from persistent surveillance data from HAP's.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The Geospatial Commission should focus on setting a high level vision and ambition for the UK as a whole to achieve and benefit from superiority in geospatial data and information management and exploitation. As stated already, this vision and ambition should clearly include Earth Observation data and resulting information products within its remit. If this is done well, the national, regional and local authorities across the UK will be able to ensure that their own individual strategies, despite variations, work towards delivering the overall vision.

As a starting point, the nations and regions could be mandated to adopt a minimum set of common approaches, standards, interfaces and policies set out by the Geospatial Commission, with each free to exceed them, while remaining compatible. Compatability is key. From an industry perspective, it is essential to adopt a straightforward approach which does not introduce new barriers – the strategy should be like an over-arching framework that permits national, regional and city level adaptations. There are a number of components that should be agreed centrally to ensure compatable access to data across the whole of the UK and NI. These include:

- Common Standards (using existing International standards) for data, metadata and services associated with access to the data
- Common data formats, themes, feature definitions
- Shared and consistent access platforms – not centralised repositories, but a Clearing House or data catalogue concept

- Pricing and licensing – a common strategy covering the whole of the UK and NI, so making it easier and simpler to obtain and use data

- Common Governance process for updating and changing the above

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The key challenges here are (a) the lack of a clear and consistent set of standards and mechanisms for local authorities and other public sector organisations in the UK to record and share information regarding their services, and (b) the lack of any clear (centrally driven) incentives for them to do so. Leadership from the Geospatial Commission in this area will help to promote openness and sharing across these organisations.

Measures that are likely to help include:

- Develop common standards for all local authorities to adopt;
- Provide training and upskilling/reskilling amongst local authority users;
- Provide access to low-cost geospatial software tools;
- Develop a national geospatial data access mechanism (as per Q9) that local authorities are able to access and contribute to;
- Develop national geospatial data quality benchmarks/standards
- Establish special interest groups for knowledge sharing
- Share information and best practice through conferences / working groups

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

It is not clear why the Geospatial Commission has selected these 5 sectors for private sector use cases specifically, as there are many others to consider, including financial services, healthcare, insurance, smart cities, climate & energy, maritime and border security, and many others. Each of these has several potential geospatial applications within them. Indeed the 5 themes of public sector use cases are also not mentioned above. Airbus would be pleased to participate in a workshop, with stakeholders from across the industry, to explore these and other use cases in more detail with the Geospatial Commission.

Q18: Are there any other areas that we should look at as a priority?

We would like to see the Geospatial Commission encourage development and adoption of products and services using remote sensing and Earth Observation across UK government. As data analytics and applications that integrate satellite, drones, high altitude platforms and other data emerge and evolve, along with complementing big data technologies like aritificial intelligence and machine learning, the Geospatial Commission should ensure that these vital capabilities (in which the UK has excellent heritage) are clearly adopted and exploited as part of the national geospatial strategy. Remote sensing together with data fusion with non EO datasets has numerous applications across government in helping to deliver policy priorities, provide evidence and monitor effectiveness of these policies; and any services developed in the UK to meet national requirements are readily exploitable by industry in commercial export markets.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are many potential public and private sector innovations that would be unleashed by better access to geospatial data, including many that haven't even been thought of yet. As with Q17, the most effective way to flesh these out may be through a workshop with industry stakeholders.

Potential regulatory challenges include:

- regulation around the use of HAPS, drones, autonomous vehicles and other aerial or terrestrial platforms to collect geospatial data;
- privacy issues including confidentiality and security of geospatial data that may allow individuals to be identified;
- regulation around the launch and operations of UK-owned commercial satellite constellations

In the context of Brexit, the UK also needs to ensure that adequate support is given to export initiatives through high value campaigns, trade missions, and promotion of UK geospatial capability in the international arena.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

For the UK to become a world leader it needs to foster development of scalable, operational propositions which industry can then exploit in international markets. To enable this, the UK urgently requires a joined-up national approach to collecting, storing, sharing, disseminating and exploiting global geospatial data sets, which brings together UK stakeholders from across industry, research, academia and government working together towards a common goal.

The Geospatial Commission is uniquely placed and funded to make this happen, working closely with the other key initiatives, notably the UK Space Agency's efforts to provide operational EO data access for the UK, the UK Space Sector Deal, the ISCF Wave 3 "Space Data Revolution" proposal, and the export initiatives of the Department for International Trade. With Geospatial Commission leadership and coordination, the UK can create a highly visible showcase for British technology and capability worldwide, highlighting its reputation for delivery of trusted, high-integrity geospatial data and resulting information products.

With the Geospatial Commission undertaking the "intelligent UK Governement customer role" the Geospatial Commission would provide the "as used by the UK Government" recommendation to support the export of UK geospatial services internationally.

Once we have a coherent national approach including the provision of services by UK governement, UK capability and services will speak for themselves in the international geospatial world. There are also several international fora where the Geospatial Commission can actively promote UK capability – for example CEOS, UN-GGIM, GEO or the International Charter for Space and Natural Disasters – working closely with UKSA, Defra and other relevant UK bodies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The European Copernicus DIAS platforms are rapidly becoming centres of gravity for hosting EO and complementary non-EO geospatial data in Europe, along with relevant tools, storage and processing capacity to exploit the data, and with e-Commerce facilities to enable commercial applications to be built and served.

Australia has invested significantly in its open data cube implementation, which has now been embraced by CEOS. Some states like Queensland are routinely procuring state-wide high resolution coverage on an annual basis and making it available to its public services.

France and Germany have invested significantly in national EO data centres (PEPS and CODE-DE respectively). The Netherlands is routinely purchasing satellite data coverages of the country, as well as collecting Sentinel 1 and 2 data, and making raw and pre-processed ARD freely and openly accessible to Dutch users from government and industry.

In terms of geospatial big data implementation, North America is leading the way. The USA has established a national geospatial platform (www.geoplatform.gov) and Canada is establishing its own Federal Geospatial Platform. In the commercial sector, North American orgnaisations such as Amazon, Google, Planet, Maxar/DigitalGlobe, BlackSky, Urthecast and others are investing heavily in this domain, recognising the commercial potential.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Dear Sir / Madam,

We would like to submit replies to three of the questions raised in your questionnaire. They are:

Q16 - How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

At the moment the logging of location intelligence data for public safety is inconsistent at best and almost non-existent at time across the whole public sector. The same applies for the sharing of this data across local authorities and other public services such as the emergency services. This state of affairs exists despite numerous very high profile and often tragic cases that have occurred due to these failings.

Examples of location intelligence can be categorised into 3 main areas. The building or location where there has been a recorded risk to staff safety. This can range from a dangerous dog, an occupant with a history of violence to storage of hazardous materials. The second category involves location intelligence relating to vulnerability of the occupant(s). This can range from a medical condition, mobility to safeguarding issues. The final category involves attributes of the location that can impede staff activity in any fashion. This could be the absence of a lift, narrow access to alarms, etc.

The obstacle to this arise from a lack of formal standards to record this sort of information and the lack of political will to share this information within the local authorities and other public sector bodies.

The benefits of having a formal standard for recording and sharing this information can be seen by the impact of introducing BS7666, the national standard for addressing in GB. This has enabled the proliferation of multiple solutions that conform to this to be generated and supplied to the public sector. It has helped form a truly competitive market place and not a fabricated one dominated by monopolies. Organisations large and small have built innovative solutions that drive down costs and improve efficiencies. The adherence to a standard also means a public sector organisation is not completely dependent on one solution and one supplier. This is essential for competition to work. If a better solution is available, this can adopted without compromising the whole operation of the organisation. A common standard for location intelligence information described above can have the same catalytic effect, benefiting public safety without overburdening the tax payer.

The second and possibly more intractable issue is the political will to share this data. There is a clear understanding that this is important at central government, local government and within the various public sector organisation involved such as emergency services and health. However, there has been little or no leadership shown to make this happen. The current hostile environment and blame culture across the media and public services make it increasingly difficult for people with vision to drive a change through. The introduction of new legislation unfortunately gives people more things to hide behind and use as an excuse for inaction. No easy solution to move this forward exists. However the current positive intentions have not produced anything meaningful. A framework needs to be created with clear guidelines on what information can be shared and how that gives public sector leaders the legal protection needed to do something. This in conjunction with a national standard may help overcome the current inertia. This probably needs to be accompanied with a firmer directive from central government that mandates the sharing of this information.

If this can be achieved, it will highlight the huge benefit of geospatial data to public safety as well as stimulating innovation and growth in the private sector suppliers that will invest to provide solutions for this.

Q19 - What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

The introduction of an Emergency Services Gazetteer.

The AddressBase Premium data set provided by the OS is currently being used by most emergency services to form the base address dataset for their operational systems such as command and control used for emergency response. Whilst this is a major step forward for emergency services, the success of this data and therefore more extensive and aggressive use has also highlighted some limitations. There are multiple categories of location based data that are currently not being stored in this dataset that would prove hugely useful. For example street junctions and motorway marker posts are very important for efficient emergency response.

There is a reluctance to include this sort of data in ABP as there are multiple other users of this data who will not be interested in this. This can be resolved by the creation and maintenance of a dataset specifically designed for the emergency services. This concept has been talked about for over 10 years but nothing concrete has been done to achieve this.

As a provider of address management and gazetteer systems to around half the fire, police and ambulance services in GB we have seen a consistent demand for this from all our clients. We have often put in place tactical solutions to cater for the immediate demand, but we believe that a national, standards based approach will be far more beneficial and cost effective for all the emergency services in the country. Our discussions with the OS have also led us to believe that this is seen as a preferred route from their perspective as well. As a significant private sector supplier in this space, we would fully embrace the introduction of an emergency services gazetteer and will put in significant investment to produce and deploy compatible solutions to all our clients.

Q20 - How best can we make the UK's presence in the international geospatial world more visible?

The UK has a very sophisticated and despite the many issues a very efficient geospatial ecosystem. We take many things for granted because of our geospatial heritage. The benefits from this we experience simply do not exist in most countries in the world. We have the standards, technology and business processes to support geospatial use in both the public and private sectors. This can become a huge revenue source for the country if deployed across the world.

The contributors to this ecosystem are many, they vary considerably in size and international presence. Currently each contributor has to make their own efforts to reach out to the international market. This effort is considerable and often prohibitively so for most. It is also often completely uncoordinated. The benefits of systems, standards and processes that work seamlessly together is often lost when looked at in isolation. Given the huge logistical issues with doing business abroad it will be very useful to work in a more coordinated fashion with government assistance where necessary.

A geospatial sector specific initiative that promotes an overall business solution abroad and sponsored by the government will be very useful. The focus should be on overall solutions to business / economic issues helped by geospatial solutions rather than the technology. This can be set up and coordinated by leaders in the geospatial industry. This should be focused at specific countries where current initiatives are being planned. We need the DIT people on the ground to be briefed on the things to look for and highlight them early so early intervention by geospatial experts can take place. There also needs to be an emphasis on solutions that deliver benefit rather just strategies that a nation can adopt.

This coordinated approach with the help of the government can help realise currently untapped geospatial potential in the UK.

Regards,

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Anglian Water Services
Job title	[Text redacted]
Address	
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There should/could be an inclusion of a fifth data type to specifically understand how best to record direct same sector relationships between assets. For example; pump to storage to customer property via a network of assets, and indirect such as customer property supplied by third party infrastructure. This would include spatial data types and relationships supporting activities such as flood risk and the ability for historic and predictive time lapse data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Capability should be delivered through the opportunity to promote geospatial skills at all levels of education, including primary schools at an introductory level. Skills share a common foundation with lessons around 'coding'. Further courses could enable students to learn how they can apply skills they learn in other subjects such as modelling, CAD, statistics and mathematics. This will enable both analysing the past, predicting the future and the application of algorithms such as simulations and optimisations. The systems and data required should be accessible and affordable enabling a greater audience to be reached and developed.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We would value other training providers support to explore applied and multi-disciplined training giving a wider view of the synergies and opportunities available. Subjects may include geospatial data and systems (GIS) development to customise existing products, satellite image classification and combining GIS with other skills. Training could be combined in a tailored industry approach and opened up to a wider audience other than current GIS analysts. Potentially it could be promoted alongside digital twin capability as career path to attract people who are equally interested in exploring careers in computer game creation, as many of the technical capabilities are shared with those enviornments. There is also opportunity for further dissemination of system administration of the GIS platforms to a super user level from a centrally controlled IT environment, enabling a more flexible and more dynamic model responsive to change and the business needs.

Finally, one of the most restrictive gaps is the technical understanding of how to integrate existing geospatial data and capabilities across systems. The greatest power and opportunity (hence the lure of 'digital twin' concepts) comes by bringing all static and dynamic data about the physical world together through their relevant temporal and spatial references. Existing GIS systems are not suitable for consolidating and processing all data types. Generally IT development is compartmentalised into 'trades' of resources who specialise in one technology development over another. Being able to create skills, capabilities and career paths for technologist and information specialists that bring system functionalities together to minimise data silos is essential.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Some datasets are currently disparate, being sourced from Local Authorities or Regulators and use different standards and refresh rates, and of variable (and often unknown) quality. Up to date quality open source data available via a centralised national web services portal is desirable. This could be enhanced by Sharing data with other utility companies to reduce health and safety risks, traffic disruption to customers (planned and current work locations), and create a supporting and sharing environment on shared interests such as customer/property occupancy figures. Infrastructure owner/operators with extensive networks of buried services must all find a way to share and be comfortable with sharing where all our known buried services are.
The detailed and updated access to topographical datasets including the built environment. Building detail is extremely valuable (occupancies, as well as volumes/capacities) to predicting received water pressure and predicting flooding at structures.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address Base Premium is a complex dataset which due to its nature is inherent. At its core there must remain a freely available nationally controlled dataset which all are encouraged to use based on three main aspects:

1. Is the address a natural thing (such as a pond or a field) an industrial structure (such as a dam or a turbine) and collection of structures (such as an oil refinery or a block of flats) a commercial premise (such as a shop or an abattoir) or a dwelling (such as a house or a caravan)
2. Is the address just one of the above – or does it either contain, or is it contained, within one of the above
3. Can the address be delivered to (e.g. a church with a letter box) or not (e.g. a church without a letter box)

In addition we believe that as part of the smart cities strategy we should have access to all public services data. This could include smart sensors accessing council records to understand occupancy rates.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

There needs to be more emphasis on low orbit satellites and sensing technologies which focus on the UK. This would provide the potential for analysts and automated algorithms to look for change using different wavelengths. The data needs to be provided at an affordable cost as it is currently priced out of our remit. This could be supplemented with more drone data and can be used for a range of purposes such as leak detection, monitoring the health and composition of natural water sources for public and potable use, asset planning and growth. The cost of data provision could be supplemented by value added services and a premium paid for closer to real time data.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Satellite data, including 3D views, focusing on refresh rates and resolution for an affordable cost is important. The government should focus on attainability, the industry and open source community will fill in the analytics and development provided it is of a quality resolution and it is refreshed in a timely manner. This is to include weather forecast information as it forms a vital part of the sectors business and impact on the customer. This could be provided through a web services library made up of public and private web mapping service.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and systems with rich attribution and connectivity will support any new technology and decision making that is required to provide a service to a customer, understand market locations and density, or understand one asset in relation to others across the whole of the physical world. Consistent data definitions, standards and schemas are critical to its wider use and 5G telecommunications rollout would be a supporting factor. This is all an enabler to make smarter or efficient business decisions in the future and steer further technology enhancements to benefit the our customers and the public good.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

AW are a private sector organisation who currently pay for a whole range of geospatial data sets because we see the value they bring and appreciate how fundamental they are to our efficiencies and service provisions to customers. We currently purchase those data sets predominantly through individual arrangements with each separate public organisation. Purchasing data sets through more 'streamlined' / consolidated routes would be advantageous and we suggest realise efficiencies for both the data provider, and AW as a data user. There is considerable value to these data sets and we recognise that as a major infrastructure owner/operator we are prepared to continue to invest in them as long as they realise more and more value over time.

As private and public organisations continue to invest in BIM / geospatial processes and capabilities, and digital twin capabilities internally within their own companies and sectors, there is great opportunity to drive through symbiotic relationships, collaboration and even National Regulation, the return of updated and enhanced geospatial data and records from private companies back into the public guardians and maintainers of the national records.

The business cases exist for any organisations to realise value from geospatial applications etc, regardless of sector. Following intial start-up costs, is there opportunity for re-investment of efficiencies realised by public sector organisations back into further enhancements of data sets? Can the Commision play a role in facilitating this?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

There is an essential requirement to locate, track and assess the condition of underground assets, standardising this data and making the technologies affordable and available is a priority. Ground penetrating radar is an option to gather this data set, we are open to any way to deliver this capability. Unknown locations of buried assets is a significant issue (cost and safety) to all infrastructure owner/operators and their supply chains, and an opportunity if solutions can be found. There are further opportunity from sharing assets acorss utilities (fibre-network using water / sewerage network etc)

Investment in indoor positioning units to support on site locations, i.e. work inside buildings at water treatment works and health and safety.

Point cloud information and context capture (photogrammetry) so that we have more contextual information about geography, and the capability to easily align and post it to GIS. Ariel photography as a public owned asset.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Sharing of non-sensitive, non-competitive geospatial and geological information, with clear publication of the quality of this data against consistent measures. National standards for data quality from a 'Regulator' would support consistent sharing, as would a conitous review of what must / should / could etc be shared.

The private sector should support by investing in best practises for collecting and mastering / manging geospatial data. The incentive for private companies to contribute and collaborate would be the access to far greater quality and quantity of geospatial information, whose provenance and definition is understood.

There is no reason why the private sector should not develop and maintain the underpinning infrastructure, providing it is a carefully regulated environment that guarantee's security, resilience, customer service and appropriate pricing tariffs (if required).

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges include having to create and manage composite datasets from different sources (e.g. councils) and formats, which can be time consuming, costly, difficult, and creates uncertainty or lack of trust in decision making due to variable / unknown quality..

Industry standards for data definition, formats, attribution etc would be welcomed. Common translation tools would be beneficial.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We agree with the statements on the creation of the Commision on page 21. Ultimately the UK needs a leader, coordinator, enabler/facilitator for bringing together all aspects of Geospatial data provision, accessibility and sharing.

The user community needs a 'body' it can work with to continue to develop and influence national geospatial data strategy, define best practise with, and trust that they will continue to guard and improve data quality, consistency, understanding and accessibility. This may include enforcement through regulation if necessary.

When major cross sector geospatial data intiative are required we can see the value of Commission leadership to drive and potentially even manage the funding or coordination of activities. We also need leadership that guards the quality and usability of any technology used to facilitate the industry.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Greater access to demographics, environmental, and population data could provide greater freedom for analysis. Again the interoperatiblity between these datasets could be key to understanding potential benefits and value. Heights and volumes of buildings and structures are also data sets that many organisations have only more recently become effective and competent at managing, yet the infrastructure sector is very mature, therefore large gaps in our records exist. The latest available drone/satellite datasets, captured at various heights.

Currently 'static' data is the immediate focus of the Geospatial data strategy, that is clearly the first priority and need. When we consider the principals of 'digital twins', the geospatial data layers are the fundamental pillars. The greatest value for users comes when reliable and timely dynamic geospatial / positional data is introduced. The internet is used as a source for open gathering of current / up-to-date activities that are occurring within a specific geospatial area; e.g. "What's in my area" or "Traffic watch". These are becoming essential sources of contextual knowledge for infrastructure owner/operators, but they are not necessarily reliable or trusted sources for critical national infrastructure providers or public service organisations. They do not contain the specific features that are necessary for companies like AW to make strategic and operational decisions on behalf of the public good. "Google streetview" and "Google Earth" are open sources that are used to identify and plan a wide variety of activities, but they are almost never 'current' and therefore introduce risk in decision making. We believe that the Geospatial Commision should consider a role within this space for critical national and public service and infrastructure providers; bringing the static AND dynamic worlds together.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Ensure that the Commision applies and embeds best practice from the information management sector.

A centralised capability to manage and share provenanced local authority data, where local authorities could manage their own data within the 'system', using a set of universal standards. If a local authority does not have the ability / capability to meet these standards, the centralised capability should help them achieve this. The centralised capability could involve an OGC (open geospatial consortium) compliant web map service and web feature service library, with central system management / administration.

If the Commission facilitated the demonstration of benefits, value and business case that could be realised by using the service specific to Authority targets and challenges, that could drive uptake and adoption.

Expanding this service to include core aspects of infrastructure provision assets/features and activities would also drive further compelling reasons to use the service by all parties.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Property and land:

- Reducing the time and effort to identify land owners for access / ahead of planning for contruction activities
- Understanding planning or access restrictions, survey requirements and implications for biodiversity (flora and fauna) and sensitive land areas
- Identifying and managing bursts and leaks, or pollution events from our networks of assets (satellite imagery and reliable and up to date aerial footage etc.)
- Pre-inspections of ground conditions ahead of construction etc

Infrastructure & Contruction

- Speeding up and reducing the cost of contruction activities
- Sharing data from buried services from all infrastructure owner/operators which drives high costs for customers and create risk to employee and public safety due to cable and pie strickes etc.

- Undstanding the implications for customers from ALL public authority and infrastructure provider activities
- Multi agency planning and response to major / regional / local incidents, e.g. flooding events (having the reliable environment to collaborate within at these times would realise major benefits for the public good)

Mobility
- Trusted road works sources
- Transport route optimisation
- Supporting technologies for driverless vehicles for contstruction etc
- Ability to use geospatial data and route applications (3D) to plan and deliver un-manned drone flights for inspecting assets at height or within hazardous environments

Natural resources
- Understanding the implications for land use changes and climate change; pluvial, fluvial and coastal flooding and erosion
- Alignment of weather data and geospatioal details in near-time / real time for scenario planning and operational management of activities
- Satellite imagery of natural waters / resources used as raw water sources; levels, flows, temperature, organics and composition etc

Sales and marketing:
- Understanding our customers needs from other service providers, and as a source of information and knowledge regarding how best to contact customers within an area; demongraphics and organisations etc.
- Source of spatially tagged social media / aggregated information to enhace decision making

Q17: Are there any other areas that we should look at as a priority?

Reliable and up to date 3D applications, and particularly 3D interpretations of the existing geospatial datasets; Google Earth as previously mentioned is not consistent, up-to-date, or detailed enough for all decision making.

Augmented reality and virtual / immersive applications and functionality across the geospatial information sets, to enhance decision making, reduce costs and increase the service quality to customers, across a range of planned and reactive activities.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The development of “digital twins” at a company, regional (all service and infrastructure providers within the same region), and national level.

The ICE and Infrastructure Client Group “Project 13” has reported across the infrastructure sector on the potential regulatory enablers and existing barriers to data sharing across companies and sectors to facilitate regional and national digital twins (please see published report).

Exploitation of drone technologies and the licensing and regulation of flying activities.

The use of hand help laser scanning devices to derive a point cloud of a pipe in an excavation or a pump in a pump house with be enhanced if coupled to positioning technology to get accurate X, Y, Z values. Whilst GPS positioning gives an initial value – extending the scan to include recognition and relative position to an existing known object would be very powerful. For example – GPS puts the water main outside house number 5 – but triangulation against the outer walls of No.3, 4, 5, 6 & 7 would pinpoint the location of the point-cloud. Thus provision and accurate mapping of known surface features in a secure UK dataset would be beneficial.

Q19: How best can we make the UK’s presence in the international geospatial world more visible?

By providing the best products and most useable service possible.
Geospatial data and info that is:

- Clearly communited what there is available (defined and of measured quality)
- Secured but accessible to everyone that needs it
- Data and info that is quick and easy to use; simple to extract, capture, navigate and share
- One trusted version of the truth, with it’s lifecycle defined, it’s quality assured, with clear and accessible policies and processes regarding how it is governed
- A common and standardised language is used for all defined terms
- Where the needs of the users across the UK is perpetually reviewed and accounted for (taking a national perspective is essential)
- Where everyone who contributes to and uses the services understands the value of the data and information, and therefore only wants it to increase in value as assets that drive services to the UK.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Countries and areas that are advanced in their development of smart city concepts must be building their capabilities upon sound geospatial technology and data exploitation.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Q1	Is our view of the geospatial data types accurate, if not what should be included or excluded from this?	I don't think any of the data types mentioned should be excluded.
Q2	In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?	If we want to build for the future, the skills need to be introduced at the earliest level and not wait until people reach the workplace or higher education. Those areas cover "now". This needs to be introduced at primary and secondary education level so that the awareness and skills become automatic.
Q3	What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?	
Q4	How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?	
Q5	Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.	It would be useful to have a single agreed standard for addresses. If we can't even agree on a standard within one government department (as Alex mentioned on Tuesday), it suggests that is one area that could build on existing work.
Q6	How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?	
Q7	Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?	
Q8	How can geospatial data and applications be used to support enhanced roll-out of future technologies?	
Q9	What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?	
Q10	What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?	We have access to GPS but Europe is developing a similar system (I think it's Galileo?). Will we have access to that post Brexit and is there anything that can be done to facilitate that?
Q11	What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?	

Q12	Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.	The challenge for us at the moment is knowing what data is available and then finding someone within another department that can supply the data, quite apart from any additional issues that arise regarding data sharing protocols and agreements, even before GDPR. We are involved with CBRN in Defra to provide data to BEIS for use in RIMNET. That was delayed due to the need to set up an agreement and it now has to be updated post GDPR to facilitate the development of NERIMNET. That's just within government and doesn't take account any third party suppliers who might need some data to facilitate the development.
Q13	How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?	
Q14	Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?	
Q15	How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?	
Q16	How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?	
Q17	As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified: property and land infrastructure and construction mobility natural resources sales and marketing hat are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?	
Q18	Are there any other areas that we should look at as a priority?	
Q19	What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and	

	are there corresponding regulatory challenges?	
Q20	How best can we make the UK's presence in the international geospatial world more visible?	
Q21	Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?	

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	APM Geo Limited (geospatial / EO consultancy)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	

Micro business (up to 9)	**x**
Other - please state	With regard to skills – Final assessor for Chartered Geographer (GIS) applications with The Royal Geographical Society, Former chair of the AGI Early Careers Network. Co-Founder and former manager of GeoData Institute's professional GIS Training centre

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes broadly. For services, I think it is useful to include *analytical services* in the higher level insights derived from these data. Providing the tools to make it easy for non-GI specialists to analyse geospatial data is increasingly demanded.

In addition generic datasets (such as terrain) that provide a means to derive additional datasets and insights from a single source is still where the "golden egg" is in my view.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The exciting developments in geospatial have increasingly come from outside the sector where people have a novel (disruptive) view.

3 things we should focus on: **increasing Computer science content in academic treaching and training**, GI will continue to move to web and mobile and GI people need to be well able to use and build these platforms and not rely on desktop GIS.

Open source and open standards – increasingly, there is a need for communication of geospatial data between disparate devices, that requires a common language and standards. Ironically, standards are often numerous and competing, poorly understood in practice and are not be universally adopted (even when there is a commitment e.g. within Government Agencies to adopt them).

Understanding data properly (metadata, data quality and statistics) – ultimately, insights from geospatial data relies on having good knowledge of what a dataset is and how it was collected, so one is aware of its limitations. GI professionals have a role to play here in promoting and teaching best practice, especially to people "dipping in to the best bits of geospatial" and not always understanding the pitfalls.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

My organisation is a small consultancy that builds teams of specialists so we tend to subcontract expertise we lack. Typically this is in hard core technical development skills and automation or in specific thematic areas (e.g. ecology, telecomms). Similarly, we also supply geospatial services back to these groups where they lack the skills.

Careers can be best promoted by developing a holistic strategy: from greater inclusion of geospatial in the curriculum, expansion of apprenticeships, further organizational recognition of the profession, as in recent work to have geography recognized as a government profession. Chartered Geographer could be further promoted and become a requirement (in job descriptions) to fill government geospatial roles.

Support for existing initiaitives such as Geomentor, AGI Early Careers Network, which rely on volunteers etc. to provide software, training, information, skills development, mentoring, and to share job opportunities

Grants for support for attendance of training courses – many local authorities struggle to justify cost of attending courses and are still heavily reliant on desktop systems and their skills are becoming obsolete.

Promoting careers in the sector should be easy – as you say, it is rewarding and exciting and we have some cool stuff, satellite imagery, drones etc…..

Some of the skills that are lacking are "soft skills" – talking about and promting the industry in clear and engaging ways, technical (e.g. coordinate systems) or specific such as understanding pricing and business models for new start ups.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Focus should be on datasets that are generically useful:

A **land cover dataset** with higher resolution and a more detailed classification. Corine, LCM etc. is too coarse. Other information has to be cobbled together from various sources including OS open data, habitat inventories and project specific data. But this is done multiple times by different organisations and in different ways for different purposes. The OS Open Greenspace dataset, shows how this could be assembled from other core data. Useful for planning developments, site selection etc.

A more spatially discrete population geography would be valuable - ie redistributed from unit post code to support more accurate spatial overlays. Currently this relies on datasets such as OpenPopGrid (England and Wales only) and commercial sources – e.g. CACI. 2021 census will be gathered in a different way but the requirement to know where people are and how activities might affect them remains (e.g proposed developments etc might affect them will be important). Population has generic value across different industries and I have used it in telecoms, health, impact assessment, marketing and retail to name a few.

Opening up OS Mastermap is a welcome announcement, its hard to say what will be possible until more details available on the content and thresholds. Many people will simply ‘mine’ it for the features they are interested in I suspect. Some of the enhanced attribution e.g. heights would be of great interest also but it is not clear exactly what will be made available.

Increasing the coverage and spatial and temporal resolution of genericly useful data like EA Liidar, may add more value than opening up further datasets.

Similarly, Sentinel is a fantastic resource which is massively underused in the UK due to barriers to use (e.g. size of datasets and processing knowledge, especially S1) . Some effort here to continue the Defra Analysis Ready Data and Intermediate products work will be benfecial as it will reduce duplication and provide generically useful products.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

I do not use address data much so others will be better able to comment.Clearly, the autonomous vehicle themes identified will draw heavily on them.

However, recent developments on human machine interfacing for addresss (e.g. What3Words) are over stated and in my view there will be increased *automatic* sharing of both people's locations ("My places") directly from devices and by destinations (shops, attractions) that "want to be found" as part of the autonomous vehicle and smart cities experience.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Continued creation of Analysis Ready Data and intermediate products. This removes barriers to use and cuts out a lot of duplication in terms of processing if one can isolate the common datasets and derivative products people want.

The Defra Centre of Excellence work (e.g. EODIP programme) started this. I think the outcomes and datasets could have been better promoted to show the value and to increase usage. The data storage issue mentioned in your document is less of an issue if the organisations involved (ESA, Defra, Satellite Applications Catapult and many private companies) had not duplicated effort. Greater coordination of the respective roles would also have avoided this.
If storage is a concern then focus should be on accessing the APIs and developing analysis services that permits the processing to be localized.

Curently the Satellite Application Catapult has as one of its missions to help SME's develop their ideas for EO applications and to help turn these ideas into successful businesses. Many micro businesses and SME's I talk with are reluctant to discuss commercial ideas with the Catapult due to its increasing commercial activity – effectively a competitor in some areas. The same is true of Ordnance Survey's increasing commercial emphasis.

Therefore, Geospatial Commission could act as a more neutral, trusted and non-commercial body to support SME's with their ideas.

It is interesting that this questionnaire only has 1 specific question on Earth Observation when there seems to be such huge potential and which is inherently geospatial.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Earth Observation – There is massive investment putting new constellations of satellites in orbit and to meet a demand for increased detail and currency of data. It is also likely that many drones will be incidentally gathering other useful data as they go about their business of delivering parcels etc. and this will be both indoors and out.In addition the constant logging of better connected static sensors within **Smart cities** (and an increasingly smart countryside) also presents opportunities for novel analysis and modelling.

Handling and storage of these BIG datasets is a computer science not a GI problem but being aware of the opportunities this presents and the spatial analysis of the data is something the Commission should be looking at closely.

Autonomous vehicles – analysis of data, targeted experiences and "in flight" information for users about where they are and what's around them that might be of interest. Works at multiple spatial levels to tailor the shopping experience and define footprints. Being able to have a delivery of a parcel while you are mobile. etc.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

To provide the underpinning location datasets - 3D models, key highways assets, routing etc. and the realltime location and situation element (weather, traffic etc) via sensor networks.

Analysis tools based on machine learning and visualization of the data – being able to process large volumes of data quickly and leveraging the geospatial elements to provide new insights and visually succinct findings (including from incidental data collection). A good example of this was an EODIP project for RPA (OS, Satellite Applications Catapult and apmgeo) using machine learning to classify ortho imagery to detect land cover changes.
Geospatial underpins so much of what will be needed. These new technologies are all about people and things and where they are located at any point in time; as well as an understanding of how this might change.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

There will always be a tension between creating and maintaining high quality datasets and the requirement to make datasets more open. The tiered approach which is being proposed for OS MasterMap has the potential to allow many users to benefit and seems to level the playing field. I need to study the detail and thresholds when available to see how workable this is and whether as a concept it could be expanded to other datasets.

For me though the focus should be on datasets that have generic value, enhance the coverage and frequency of things like LiDAR and ortho derived height data – speed up the national roll out.

Extend land cover mapping work to provide generically useful classifications.

Continue to enhance core reference geographies like Mastermap with further attribution and make that available, as currently this activity is being duplicated by many from the data they have available.

More open data for the offshore zone is of interest to developers, conservationists etc.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

As we will no longer have full access to Gallileo following our exit from the EU, I would say that having our own satellite based positioning capability should be the top priority both for UK defence and UK PLC.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

A varied one. Advisor on best practice and user requirements, as they often have a better market insight and knowledge of the downstream use of the data from their own clients. Data creator to increase temporal and spatial coverage – and with more players in the market than currently exist. Currently this feels a bit like an exclusive club and provided that standards and specifications are tight, I see no reason tthis could not be opened up.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes, there needs to be better local collection and collation of datasets to enable national pictures to be assembled. I recently tried to assemble vulnerability data for local authorities and data were non standard and varied in quality. They required considerable reconfiguration even though only a small number of authorities were considered in that case.

This is also true of some government agencies with area teams and where standards are helping collate data more effectively and to allow data to be connected between disparate systems. I'm involved with some work to develop a new Incident data model at Environment Agency, improving data interoperability both between the organisation's areas to permit the collation and reporting of national pictures but also sharing with 3rd parties externally. There is potential to expand this model to wider Defra family but also the partner organisations.

While many public sector workers understand the importance of interoperability, data modelling is still relatively poorly understood at an operational level within the public sector. Therefore some work to promote this would be helpful and further work on cross-organisation data modelling.

Standards will vary with topic area and not all standards (e.g. ISO) permit the flexibility or provide the detail needed at a more local level. There may also be multiple "competing" standards with slightly different emphasis e.g ISO standard, Common Alerting Protocol and various Defra standards for incident management being a good example.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Open the provision up to greater competition and more providers. As mentioned, this obviously brings with it the requirement to ensure consistency. Review the data needs of its main public sector users to see where the priorties are. The Defra Digital programme (among others) is exploring this internally for specific business data needs but this needs to go wider in terms of PSMA etc.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Many local authorities currently pay for profiling data (such as MOSAIC) to help provide services to their “customers. “ So this and other population insights would be useful in helping targeting services more effectlvely.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Focus on the things that are generically needed and apply standards and manage for local distinctiveness (e.g. coordinate systems in NI versus rest of UK) and being mindful that the best practice standard may not be what is actually used by most users. GML is a good example, great idea, but large numbers of people don’t use it. Similarly, in Northern Ireland, best practice would suggest using the new ITM Grid but we were told for a recent Sentinel project that most people are using TM65 still.

Have a wide community inputting to the strategies including representation from business (inc SMEs) and academia.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Beyond the partner organisations, more experienced local authorities can (and do) act as centres of excellence for their neighbouring / other authorities, offering their geospatial advice and experience. This could be formalized to promote standards and funded to permit them to meet more regularly and to establish national leads and data custodians for different topic areas where they do not currently exist.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The construction, property and land and natural resources categories have exploratory phases which require regional or national appraisals for different sites or based on different options, and not just optimal routing. Services which are able to assemble the key datasets data have the potential to unlock some of this value.

While the question refers to a different kind of “Capturing Economic value”, in natural resources, there is an increasing effort to value land (including its *natural capital*), in conservation and when making decisions about development options. This requires not only a good description of land cover and land use (including previously developed land) but also enhanced atrribution of the parcels to help with this economic assessment of value. The requirements for new homes on increasingly limited land resources will require good information to make informed choices when prioritizing land.

An enhanced OS mastermap type product, that includes street furniture, traffic lights and other assets and which reduced the need for field surveying for asset management. These could potentially also be gathered as a by product of other surveying.

In terms of people's health and well being, providing the datasets (or sensor infrastructure) to analyse population's living environment and potential exposure to risk is somewhere where geospatial can contribute, For example the OS Open Greenspace dataset is being used to analyse the public's access to natural green space versus standards. There is also a great deal of work being done on population exposures to noise and to risks such as air pollution, flooding etc. This is particularly interesting when used in a more predictive mode and using situational awareness (such as weather conditions). I see many more potential applications analysing sensor data in near real time to model and predict access to services (e.g. weather patterns and access to GP services); options appraisal for new development and scenario planning.

Q18: Are there any other areas that we should look at as a priority?

The themes identified will be plenty to be going on with! Given the importance of environmental issues, I would expand natural resources theme to include natural capital and use of geospatial to support environmental protection. In the UK Defra is probably the largest GI user.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

As stated previously, so much of the identified innovations relies on geospatial, including, enhancement of service delivery in a variety of forms as described in 18

Autonomous mobility and deliveries / collections etc (e.g. refuse)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

If Geospatial Commission is a success and supports UK public and private sector effectively, companies will be successful, public bodies and local authorities will be able to be more efficient and can be put forward as exemplars. Geospatial Commission has a key role in promoting UK activity overseas and in coordinating inward delegations to ensure that we present a coherent picture of UK geospatial to the world. As we exit the European Union, this will be extremely important in terms of selling UK geospatial datasets and capability.

Continiung to invest in high quality open data that others can make use of.

Work closely with academia and RGS, AGI etc to ensure research and courses keep pace with technological developments and the needs of industry, so they are vocational and UK is seen as *the* place to study.

A regular international event hosted in the UK (similar to Cambridge conference for national mapping agencies) but for whole community with any interest in geospatial, not just geospatial people.

Better data (evidence) about UK geospatial industry and its mpact and activity (like the attachment). Previous estaimates (e.g. UK location Market survey) massively underestimate the importance of UK geospatial sector. There is lots of "hidden" geospatial activity.

Work closely with organisations involved with international projects (e.g. UN, World Bank etc) as well as "GI exporters" to develop a strong international geospatial collaboration strategy.

UK should keep leading roles in UNGGIM and ensuring senior politicians are able to talk effectively about UK geospatial beyond just OS and open data.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Presumably the USA as they are # 1 for geospatial readiness above us! and others around us like Netherlands. I do not have GI experience of these countries directly and have tended to work in the developing world on geosaptial capacity building projects.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response

INTRODUCTION

Arcadis welcomes the opportunity to provide input on the Geospatial Commission's National Geospatial Strategy – Call for Evidence. Arcadis is a global multi-disciplinary built and natural asset consultancy with a large network of Geospatial professionals. Our UK Geospatial teams are working on some of the largest infrastructure projects in Europe, whilst our Information Management and Strategy and Insight teams provide thought leadership and market intelligence to a broad range of clients with Geospatial interests. As such we feel we are in a good position to provide a robust and insightful response to the Geospatial Commission's call for evidence.

Questionnaire

Please submit your completed questionnaire to:

Geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Arcadis
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	

Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**x**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the Geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the Geospatial sector itself
2. **Enhancing the UK's Geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in Geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of Geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the Geospatial data types accurate? If not, what should be included or excluded from this?

The Geospatial data defined in the 'Charter and Framework' documents is largely representative, and one could align all data into one of the data types specified. It is however a very traditional view and potentially limits the opportunity for the strategy to support emerging, innovative Geospatial concepts such as 4D data and big Geospatial data.

We feel that the term "Geospatial Services" could cause confusion: Services are inherently different to data and it's important to maintain this differentiation, along the lines of the knowledge hierarchy where there is a clear transition from Data, through to Information and on to Knowledge. Services in and of themselves that provide insights and products are not Geospatial data types but use a variety of data 'layers' to provide interpretation and aid understanding.

We note that beneath the spatial data types listed there is a wide range of ancillary data descriptors and elements that relate to the structure and interoperability of data. For example, metadata, INSPIRE, licensing, linked data and API (Application Programming Interface) concepts are all substantial elements that have significant influence on the value of data and its usability. We would welcome some form of classification for these ancillary data types.

Q2. In addition to current government policy, what are the areas of Geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We believe that the Commission should focus on developing Geospatial skills in sectors that are aligned to the emerging technologies that will have the biggest impact on the economy such as Connected Autonomous Vehicles (see response to question 7). The Commission could recommend a review of current skills across the industry and identify gaps in those skills needed for future growth, for example covering big data management, IoT, connectivity, augmented and virtual reality.

In addition, the broader digital skills focus across government needs to include Geospatial as part of its core efforts. Geospatial skills need to be developed alongside the work being undertaken in areas such as data management, analytics, data management, scripting and machine learning, to ensure that it is not linked solely to geography as a subject.

Geospatial is not just digital geography, its uses, and value covers many disciplines, it is important to ensure that its value is understood and can be utilised across academia and industry. To support this the UK should continue to invest in the training and development of not just Geography teachers, but in Geospatial as a core STEM capability.

Q3. What are the Geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Within our organisation and across the Architectural, Construction and Engineering industry there is a shortage of digital professionals with robust technical skills in Geospatial. There is also a general lack of understanding around Geospatial by non-Geospatial professionals and how it relates to their work. Both factors limit the promotion and application of Geospatial as part of project delivery and result in missed efficiencies and reduced potential for innovation. Our suggestions for addressing both gaps are as follows:

Improve Geospatial Awareness and Understanding:
Education in Geospatial should start early and at least from Key Stage 3 onwards. This is key to ensuring a future workforce with the understanding, skills and passion to continue to drive innovation and value from Geospatial.

Some good starts have been made already by the Industry in educating and supporting teachers in their use of GIS in Schools. The Esri UK/RGS (with IBG) GeoMentors initiative is a good example and starting point. The challenge faced is to enable Industry to more effectively support local schools and colleges to help them inspire the next generation.

Developing Geospatial Technical Skills:
In addition to improving the general education around Geospatial described above there is also scope to provide further support and resources to those seeking to build a career in Geospatial.

A key challenge is the recognition / awareness that one can build a career in Geospatial. There are a lot of opportunities and jobs that have Geospatial and location at their heart across public, private and not for profit sectors. These are not always clearly signposted as Geospatial/location in nature. For example, land use planning, transport analysis, store location planning, etc. Support to the Association for Geographic Information (AGI) to help drive initiatives and improvements in this place would be positive and can be delivered with impartiality by the AGI. Building on the AGI's Early Career Network and its link up with RGS (with IBG) on the Chartered Geographer (GIS) route would help focus and promote the opportunities available to people in this industry.

Creation of a formal Geospatial apprenticeship offer with a clearly designed program that could be adopted across the UK would support access to careers in Geospatial for those people where the more traditional degree and master's route does not fit.
The development of a skills framework, similar to those that exist in other industries/sectors, for example the Skills Framework for the Information Age (SFIA) that is linked to a Geospatial focussed CPD and accreditation recognised across the industry would support both existing employees, those just starting on a Geospatial career path and those yet to do so.

Q4. Are there any publicly or privately-held Geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We interact with substantial quantities of public sector data throughout the projects we work on. Much of this is from the six organisations listed in the call for evidence.

We often spend substantial quantities of time processing this data to get it into a suitable useable form. Some of the organisations have additional regional variations in the quality and/or approach taken which adds further complication and differentiation between the same data set from the same organisation. Additional challenges exist around versions of the same data for use on different/subsequent projects for the same client.

Further challenges with regards to substantial infrastructure and consultation projects also need to be worked through, where future legal requirements may mean the need to provide the evidence base on what particular data was used to make a decision. Therefore, a copy of the data or a mechanism to access an archive of the data set and features at a given time is required. This raises questions around who would hold that archive, the data owner, the processor, the consultant?

Arcadis includes a specific example here, with reference to HM Land registry data:
HM Land Registry stores data in 3 different databases.

- INSPIRE Index Polygons – open source dataset containing freehold registered property. This contains the shape of land parcel and a Unique Property Reference Number (UPRN)
- Commercial and Corporate Ownership (CCOD) dataset - sub-set of the Land Register containing registered titles relating to land or property where the registered legal owner is a non-private individual. Contains information about the title, land description, tenure type, UPRN, company name, company registration number, county, region, OS info, date the ownership was registered.
- Price Paid Data (PPD) Dataset – contains information about the title, land description, tenure type, charges (mortgages) and owners names and addresses

All three sets of data need to be joined separately to cross-reference and access the information required as part of information that is needed when delivering Development Consent Order (DCO) applications as part of any large infrastructure project.

These datasets regularly have geometry issues (data are not snapped to Ordnance Survey (OS)), there are polygon overlaps and/or gaps, ghost parcels) and attribute errors (owners names can come in upper/lower cases, there is no separation between owner and address, the same owner can have multiple addresses, etc.)

Improvements that would make these datasets of more value;

- Data quality: apply OS data standards to polygons
- Consistency with data attributes: Owners, address columns; general improvements with formats, commas, etc
- Deliver metadata or/and information notes associated with files/instructions on how to use them
- Improve data delivery structure; when paying for data you expect a full set all of information (CCOD + PPD)
- Establish a data archiving strategy to ensure that historic data can be retrieved easily when required.

Other datasets that would benefit the construction industry if made freely available:

- Ordnance Survey MasterMap – all infrastructure and construction projects require background mapping at a large scale.
- A national high accuracy DTM – all construction projects require topographic information. At early stages of scheme design this information is typically sourced from third parties, currently coverage and quality is not consistent across the UK.
- British Geological Survey 1:10,000 and 1:50,000 vector GIS data of solid and superficial geology. Essential for all ground works and currently only made freely accessible via WMS.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes. Addressing is one of the 'core-reference' geographies and should be a national asset to be maintained and exploited for greatest use/value.

PAF licencing
Postcode Address File (PAF) produced by the Royal Mail is an important input to many private sector products and services. Its value now goes far beyond its original purpose as a tool to enable delivery of the mail. It is also a critical part of the National Address Gazetteer (NAG). A review of the ownership model for the Postcode Address File should be undertaken to ensure the licensing model, availability and quality is maintained to encourage innovation rather than stifle use through inaccessibility, complex licencing terms or prohibitive costs for use and re-use.

Multi-dimensional addressing
Addressing has traditionally focussed on the location of buildings and physical structures that conceptually have a door of some form. Changes required within the 'addressing' ecosystem need to be able to factor in different types of address focused locations, across the traditional 2D environment but also 3D (multi occupancy buildings) and increasingly 4D (time) element.

Addresses and IoT
Addressing in the future will need to expand to cover more than just buildings or places that people live. It will need to incorporate the ability to record a range of items and their location over time. There are now more "things" connected to the internet than there are people. Each one of these connected things (IoT) is often located in a physical place and being used to provide hyper local contextual information, for example weather information, air quality data, what's nearby, marketing/informational data. These things need to have their address location maintained or their value and the value of their data reduces substantially.

Archiving and retrieval of object addresses
With GPS, RFID and up-to-date databases we can now imagine a time when it will be possible to know where everything is at all times. Knowing where everything is, and where it has been, creates a host of interesting possibilities for the future. An online database of the object's history could be accessed, and the object's current location is captured along with any other useful information. The result is a readily accessible geographic history of objects.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The space arena and Earth Observation (EO) has seen major investment recently in high quality commercial imagery and this is readily available through various suppliers. The earth observation sector is seeing a growth in small satellites using commercial off the shelf (COTS) technology. Companies such as Surrey Satellite Technologies changed the economics of space (Satellite Catapult) and this trend has been continued by others such as Skybox.

However, the cost of EO data is still prohibitive to many, particularly in the Public, SME and Charity sectors. As such there is potential future growth in this area that is yet to be realised, as competition and data collection costs come down and prices become increasingly affordable.

The growth in this area will continue with the development of constellations of high-resolution sensors with unrivalled temporal resolution. Other sources of remote sensor data include the EU Copernicus Sentinel constellation of Earth Observation satellite, which should be fully operational just after 2020, and will supply open data. The availability of this data, crossing into the big data, open and standards arenas, will only increase the demand of business and consumers alike, for more and varied earth observation data.

The Geospatial Commission's challenge is to ensure that UK PLC has the expertise and computing power needed to process the large volumes of data generated and the ability to easily turn this into useable products that improve productivity. To support this the Commission could:

- Support the investment in and growth of start-ups and companies to build 'at scale' the capabilities required.
- Encourage the use of EO within core infrastructure programmes in a similar way to the mandate on use of BIM and accelerate the adoption of next generation innovations such as Digital Built Britain.
- Investigate ways to incentivise companies to develop and create the downstream products that would make use of EO data more accessible and reachable. This could be done through linking with the existing catapults operating in this space.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit Geospatial data for economic growth?

We are keen to better understand the Geospatial Commission's focus in this area and how it would relate to a National Geospatial Strategy. There are a range of existing government initiatives focussed at promoting and incubating emerging technologies and associated infrastructure. The role of the Geospatial Commission could be to support industry (across private, public and not for profit) in developing these opportunities through improved use of Geospatial data, skills and technology. Please note that the following new technologies are not listed in order of priority.

Augmented Reality
The process of 'augmenting' the real world with digital overlays and insights already has a range of use cases and we expect to see capabilities in this area growing as the tools and techniques become easier to use and increasingly mainstream.

Augmented reality (AR) relies inherently on Geospatial data. Without knowing where a device is, what direction it's facing, what elevation it's at, then it isn't possible to correctly overlay data and information onto a live feed through a device, whether that be existing prevalent smart enabled technologies (like smartphones and tablets) or newer wearable devices (like smart glasses or watches).

AR has the potential to offer significant safety and operational benefits to the construction industry as well as asset owner operators. Key challenges that need to be addressed to support take up include:

- Improving the quality of Geospatial built asset data
- Improving the positioning capability of readily affordable AR platforms

Autonomous Vehicles
In just a few years' time, the most accurate maps of the world will be for cars. As manufacturers pursue the goal of autonomous vehicles, there is a need for this capability to be supported by extremely accurate location-based information about our roads and related infrastructure.

Distributed Ledger Technology (aka Blockchain)
As a decentralised, distributed and public digital register that can be used to record transactions across many computers so that the record can't be altered retrospectively, the blockchain can be programmed to record and track anything of value. For example, financial transactions, medical records, land titles, contracts, digital assets, physical assets etc.

For example, Swedish land registry, Lantmäteriet, has launched a concept blockchain for managing, securing and verifying property transactions.

This technology is revolutionary in the way it tracks and stores data, creates trust in the data, removes the need for intermediaries and its flexibility of application. There are already examples of the use of blockchain technologies within the Geospatial arena, with the creation of the 'Proof of Location protocol', 'Crypto Spatial Coordinate' and the 'Spatial Index' by Foam.

One area this technology may find significant use along with Geospatial technologies is the Internet of Things. For example, could an autonomous delivery vehicle, depending on a range of internal and location-based sensors be hijacked and driven to a wrong location? If the data carrying the delivery instructions are considered as 'transactions' and if those transactions are on a blockchain, then the process of consensus would help validate the transactions and discard the wrong instructions because the illegal transactions would be identified.

Indoor Positioning
People only spend around 13% of their time outside. Satellite positioning (GPS) is great for identifying where you are when outside and operating in a 2D environment. It is of limited help when navigating the complex multi-dimensional indoor spaces of shopping centres, hospitals, mines, airports etc. Indoor positioning is becoming an increasingly important area and one that should be focussed on as an area for new opportunities. These could include building navigation for emergency planning, improving accessibility and unmanned automated vehicles.

A challenge for the future will be the integration between indoor and outdoor positioning. There are already challenges across the Geospatial sector around interoperability of datasets, when based on outdoor positioning, this will be magnified by the addition of indoor positioning. The development of standards and integration will be key to ensuring the greatest value can be derived.

Mobility
As everyone and everything becomes increasingly and inherently mobile, understanding your and/or a device's location is ever more important. There is already a wide range of services, capabilities and value being derived through the use of 'mobile' technology. This is only going to accelerate and will inevitably be a continued area of growth.

Real time data collection/processing & analysis
Maps take time to make and as such generally only contain permanent features of the earth's surface or historical data. A navigation system fed by sensors of many different types has huge potential. For example, the 'Sensing London' work undertaken by the Future Cities catapult, where sensors measure a range of physical parameters, including air quality and human activity. The sensors and resultant outputs all have a Geospatial link and location is key to the interpretation of outputs and insights. From these findings it is also possible to assess the impact that cities themselves have on human health, wellbeing and the natural environment. From there, development of new solutions to problems that are really affecting our built spaces can be envisaged and designed. That could include anything from apps that tell asthmatics how to navigate the city with minimum exposure to air pollution, through to new business models that allow our green spaces to prosper in the face of uncertain funding, to providing evidence to justify the business cases for new technologies and infrastructure, to improving human health in the long-term.

The shift from a leisurely process of analysing static data to a much greater dynamic

process of real-time monitoring and incorporating decision making as it happens will be substantial. Geospatial will involve increasing quantities of real-time situation, monitoring and assessment which will require new tools that can treat information as continually changing. Decisions will increasingly need to be made on the basis of information available at the time and deal with uncertainties about the future in rational ways. This change in data availability will also have an impact on licensing models, it will no longer be acceptable to spend weeks/months negotiating over the terms of an agreement and/or what uses the data can be put to, or whether an output should be considered as 'derived data' or not. Advances in technology and data need to be kept up with in terms of licencing and standards and substantial effort needs to be invested to make future transactions as quick and seamless as possible.

Virtual reality / Digital Twins
The 'digital twin' concept will rely heavily on Geospatial capabilities and data. The digital twin of a physical asset helps you to understand how assets operate in a wider system and how they interact with other assets. It is a 'bridge' between the physical and digital worlds. They can be predictive and adapt physical systems to reflect changes in the environment or operations. The benefits include harmonisation of operations to deliver optimal user outcomes, clash identification and automated remediation, and cost/risk reductions. All of this should lead to improved citizen outcomes in terms of service experience and cost.

Q8. How can Geospatial data and applications be used to support enhanced roll-out of future technologies?

This will vary depending on the 'future technologies', but the one clear thing is that there are substantial new technologies emerging that have an element of location and Geospatial to them. It will be important for the Geospatial commission to link up with Innovate UK and the different catapults many of which are already working on data and technologies with an inherent location/Geospatial aspect.

One specific area where Geospatial data and applications can support, is in the role out of 5G across the UK. Ensuring masts are positioned to provide greatest coverage while considering population densities, infrastructure and elements of the environment both natural and built that will impact signals is a core strength of Geospatial capabilities. Other potential applications include asset positioning, tracking and monitoring in a connected sharing economy.

Please also see detailed response to question 7 which includes Mobility, Autonomous Vehicles, Indoor Positioning, Blockchain, AR, real-time data collection and analysis and VR/Digital Twins.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our Geospatial data assets?

There are a broad range of funding options available for consideration and a range of different models are currently in place across the UK. The funding in and of itself is not as important as the need to have geospatial data and services available that are of a good quality and sustainable.

While open data is fully encouraged, it is the "open" aspect, availability for use and re-use and not the "free of cost" aspect that is the real value. Ensuring interoperability, access and usability of Geospatial data assets is key to ensure opportunities are maximised.

Public sector organisations should identify those Geospatial data that create value and subsequently could be revenue generating. Such potential revenue streams could support a business case for further investment / funding. In some cases, this might involve revising existing licencing and data revenue models. Examples of such datasets include Ordnance Survey MasterMap, which if fully open with an alternative revenue generating model in place, could be used more widely.

Additionally, we also note that there are substantial other public sector (and public sector related) bodies creating and consuming Geospatial data and services, for example the Environment Agency, Local Authorities, NHS Commissioning groups, Met office, GeoPlace, etc. that need to be considered alongside the six currently referenced in the call for evidence.

Q10: What areas of the underpinning Geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for Geospatial data?

As previously highlighted, the increase in autonomous vehicles in the coming decades, combined with the requirement for on-demand high accuracy data means that our geospatial infrastructure needs to be made ready. A key priority in developing this will be improved access to accurate geodetic networks to support improved on-board positioning by drones, driverless cars, other mobile IoT devices and real-time applications.

It is too early to tell which indoor positioning infrastructures will emerge as viable long-term solutions. It would be of value if the Geospatial Commission could support the industry to fast track to a point where a technology standard for indoor positioning is reached so that products, services and emerging capabilities can be reliably built for the long term.

The EU Galileo initiative, of which the UK has contributed to substantially will be a significant development for the accuracy of outdoor positioning. Arcadis is keen for the Government to ensure continued access to the Galileo programme as we leave

the European Union. Without this, the UK is at risk of falling behind at both a European and global level with regards accuracy of available global positioning systems.

A challenge for the future will be the integration between indoor and outdoor positioning. There are already challenges across the Geospatial sector around interoperability of datasets, when based on outdoor positioning this will only be magnified by the addition of indoor location. The development of standards and integration will be key to ensuring the greatest value can be derived.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's Geospatial data assets?

The private sector already plays an important part through a variety of contracts with a wide range of government departments, agencies and enabling infrastructure technologies.

Moving forward it is important that private sector organisations are involved in the steering and development of UK Geospatial assets, this could be via the following mechanisms:

- Through including private sector data providers, platform providers and data consumers in key policy and strategy development panels and initiatives.
- Through allocating innovation funding to public sector capital projects and supplier frameworks being delivered by the private sector.
- Through partnerships between start-ups, SMEs and big business. This could take the form of engagement with incubators such as OS Geovation.

The private sector will potentially also see the greatest growth in new Geospatial data, services and markets as crowd-sourced information from connected users and devices continues to expand. This will potentially increase the demand for regulated public sector geospatial data and frameworks to support data re-use and provide context. There is also the potential for new private sector data to augment UK Geospatial assets, adding further value. To capitalise on this, thought should be given to the data standards and licencing models of the future and how these can be established to maximise productivity and citizen outcomes.

Q12. Do you face challenges when working with Geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of Geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We use a broad range of public sector Geospatial data sets from across Government, Local Authorities, Devolved Administrations, arm's length bodies and the public data corporations.

One of the consistent challenges is in the interoperability of data and the ability to link it together for analysis and interpretation. Overall quality can also vary widely as does the enforcement of Metadata standards, particularly for data that falls outside the current INSPIRE regulated data.

Despite the UK exiting the European Union the INSPIRE concept has, at its heart the value of trying to create harmony in Geospatial data products and the ability to combine them together. This principle should be retained and built upon across the UK Geospatial sector to improve interoperability of datasets.

As referenced previously, licensing restrictions can cause substantial barriers, both in terms of complexity and cost. Complex licence arrangements mean that excessive time is often spent trying to achieve compliance, whilst any cost immediately reduces the scope of activities that the data can be used for.

For example, design consultancies are unlikely to pay for an OS MasterMap licence to support work on a tender for a scheme that they are not 100% sure they will win. This means that other "free at the point of use" datasets will be used which are often of a lower quality either in terms of age, coverage, accuracy, precision and attribution. As a result, the tender submission will be priced to include more risk than if informed by a better dataset. This price is then passed on to the client and in the case of many infrastructure schemes, the public purse. This is not good value for the public who have already paid for the development OS MasterMap. This situation is exacerbated by the fact that many public sector bodies do not make their Geospatial data available as part of procurement.

A potential way forward would be for public sector bodies to include temporary licence agreements and data within their procurement packs. In the longer term there may be merit in revising licencing and access arrangements to data for organisations working on public sector projects.

Q13. How can the Geospatial Commission act as a more effective customer for Geospatial data on behalf of the public sector?

There would be value in the Geospatial commission establishing a user group to represent interests and gather feedback. This should be representative of all interested groups, public sector, private sector, academia and the third sector to ensure the views of the wide range of users of public sector Geospatial data can be considered effectively. Alternatively, the Commission could seek to use existing industry networks that operate in this space: Public Sector Mapping Agreement (PSMA) user groups for government focus and the Association for Geographic Information for a broader impartial representation of views across the industry.

More broadly this is a complex area and we suggest that further work to explore options and gather evidence should be undertaken to inform how changes could be implemented to improve the current situation.

Q14. Are there any additional Geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We believe that improved access to the following datasets would be in the national interest:

- **Royal Mail Postcode Address File (PAF):** Postcode Address File (PAF) produced by the Royal Mail is an important input to many private sector products and services. Its value now goes far beyond its original purpose as a tool to enable delivery of the mail. It is also a critical part of the National Address Gazetteer (NAG). A review of the ownership model for the Postcode Address File should be undertaken to ensure the licensing model, availability and quality is maintained to encourage innovation rather than stifle use through inaccessibility, complex licencing terms or prohibitive costs for use and re-use.

- **Utility network data:** Information on buried utility service locations is required for all infrastructure and construction works to inform design, estimate construction impact and ensure project, scheme and staff safety. This information is typically owned by the utility network providers. It is often hard to obtain and when supplied is usually in a hard copy or PDF format with significant use restrictions. Providers are reluctant to share digital utility data for reasons of liability, security, revenue and cost. The development of a national utility database to inform early stage construction design would improve safety and save money through improved pricing and reduced delivery costs. The development of such a database would also require a review of how project risk and liability is owned in relation to infrastructure data.

- **Infrastructure topographic data:** Both Highways England (HE) and Network Rail (NR) hold large topographic datasets of their networks. This data is typically only available for use on HE and NR projects and coverage across all of the UK rail and highway network is not complete. As a result, there is no consistent topographic dataset to support UK infrastructure development. The establishment of a national high accuracy Digital Terrain Model would provide a single topographic dataset of known quality to inform early stage scheme design. This would reduce costs associated with pricing in risk and onerous data collection. There is also potential benefit to making this information available publicly, to support innovation and re-use in other applications.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The call for evidence puts forward two different scenarios for initial consideration. Both of these options could work. What is key in either option is to ensure there is commonality, engagement and involvement and the identification of core elements that need to be consistent across all aspects/parts of the UK.

It would be useful to acknowledge that there have been previous GIS/Geospatial strategies for the United Kingdom. 'Place Matters: The Location Strategy for the United Kingdom' was launched in 2008 with an aim to "maximise exploitation and benefit from geographic information and to provide a framework to assist European, national, regional and local initiatives".

For a Geospatial Strategy to be effective there needs to be a clear understanding of how it aligns with the other strategies and initiatives across the UK that have substantial cross-over and interest in Geospatial. For example, 'Transforming Infrastructure Performance' published by the Infrastructure and Projects Authority in December 2017, Innovate UK, The National Infrastructure Commission 'Data for the Public Good' report in 2017, The Catapult Programme, the UK's Industrial Strategy and Digital Built Britain. These relationships should be articulated in the resulting Geospatial Strategy.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Mandate Local Authority support to maintain changes in core Geospatial datasets.
- Invest in Local Authority GIS teams as drivers of efficiency and growth.
- Integrate data that Local Authorities are responsible for, for example Bus routes and bus stop locations, into core regional and national transport datasets, to support multi-modal connectivity and analysis.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential Geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Use of blockchain in the property/land transactions environment
- Infrastructure design and construction:
  - Improved data accessibility and availability for early stage planning, feasibility and outline design desk studies.
  - Improved terrain and 3D topographic datasets for scheme visualisation, stakeholder engagement and public consultation.
  - Improved terrain datasets for earthworks design.
  - Improved utility information access to support planning, design and damage assessment.

We also suggest identifying those services and pricing models which will potentially be very high volume but low price. For example, IoT and CAV both have the potential to grow to a very large size very quickly. Identifying the critical Geospatial data and services required to support adoption, growth and maintenance of these systems will help identify potential revenue streams that could add large scale economic value.

Q18: Are there any other areas that we should look at as a priority?

We recommend a review of data licencing, governance and sharing models for projects in the architectural, construction and engineering sector. Current licencing models inhibit efficient data use across the built asset lifecycle and result in significant duplication of effort across supply chains and assets.

Q19: What are the main potential private and public sector innovations that will rely on the use of Geospatial data to rollout, and are there corresponding regulatory challenges?

Most private, public and not for profit organisations rely on and use Geospatial information in one way or another. As referenced in this call for evidence there are a range of innovations that will rely on Geospatial data (see response to question 7 which includes Mobility, Autonomous Vehicles, Indoor Positioning, Blockchain, AR, real-time data collection and analysis and VR/Digital Twins) and some regulatory changes around licencing and standards have been noted.

As people become increasingly aware of data privacy and data protection, the specific challenge around location privacy will need to be addressed. Regulations and guidelines need to be developed to ensure innovations and emerging technologies do not damage an individual's fundamental rights with regards to their privacy.

As the range and quantity of Geospatial applications and data increases, so will the need to engage with private sector data owners to ensure that data is used and managed in the national interest. How, for example will the UK ensure that data derived from Connected Autonomous Vehicles is made available to improve transport infrastructure design? What standards will be applicable and licencing models applied?

Q20: How best can we make the UK's presence in the international Geospatial world more visible?

The UK has a thriving Geospatial sector with a lot of opportunity and potential. The Geospatial Commission should support the Geospatial industry organisations like the Association for Geographic Information (AGI) which can act as the impartial industry body and as a hub for Geospatial initiatives. Similarly, the Commission should seek to capitalise on Geospatial success stories in the private sector and look to organisations such as BAe, Jaguar Landrover, BP and National Grid who have large Geospatial user communities and global networks.

International visibility could be increased by including Geospatial representation from the AGI in international trade delegations and Department of Trade and Industry visits. There may also be merit in the UK exporting Geospatial best practice to other countries by establishing Geospatial Ambassadors with partner nations as part of a broader suite of bilateral or multilateral trade.

We note that the UK Government has adopted the United Nations Global Geospatial Information Management (UN-GGIM) Integrated Geospatial Information Framework (Aug. 2018) as best practice for developing strategic Geospatial interventions and believe there would be merit in reflecting the UN-GGIM guidance in the Commission's approach.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The UK is itself a leading global exemplar in Geospatial data and technology. However, one improvement could be to develop data procurement related to built assets, around the digital asset lifecycle, to reduce the number of silos of data maintained for the same physical asset.

Good examples of this can be seen in the United Arab Emirates and in Qatar where much of the data related to infrastructure and property development is being created from scratch as these countries urbanise. In many cases standardised Geospatial data is mandated by clients as part of the design deliverables for new build assets. There is a recognition in these countries that Geospatial data related to new assets is a useful asset, that can put to work to support other government initiatives or subsequent stages of the asset design process. This contrasts with the UK where it is very rare for Geospatial data to be specified as a deliverable as part of a Highway, Rail or Residential scheme design, even though it would be useful at subsequent stages of the design process. As a result, this data is created "unofficially" several times throughout the design process by multiple suppliers, in a way that is un-standardised and ultimately inefficient.

We note also that the Netherlands has a strong culture of utilising Geospatial and is ranked number 1 in the recent KPMG Autonomous Vehicle readiness index.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via Geospatialcommission@cabinetoffice.gov.uk

THE ASSOCIATION FOR **GEOGRAPHIC INFORMATION**

NATIONAL GEOSPATIAL STRATEGY

RESPONSE TO CALL FOR EVIDENCE

OCTOBER 2018

agi.org.uk

[Text redacted]

Geospatial Commission:

Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Organisation	Association for Geographic Information
Address	[Text redacted]
E-mail	[Text redacted] Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	
Business representative / trade body	**X**

Association for Geographic Information

Executive Summary and preface to our membership's response

As the Association for Geographic Information, we are privileged to represent the widest cross-section of the UK's geographic information (geospatial) industry. The AGI welcomes the establishment of the Geospatial Commission and this opportunity to present the informed position of our members to government through this Call for Evidence. The AGI is ready to support the Commission to shape the UK's first National Geospatial Strategy.

Since this Call for Evidence was announced, we've been gathering insights for this response from AGI members in England, Scotland, Wales and Northern Ireland. We have spoken to young professionals with a vested interest in developing long-term careers and to experienced academics; to innovators and specialists; to companies of all sizes in the private, public and third sector; and to organisations representing the affairs of both local and central government. This document is an aggregation of their informed, evidence-based inputs.

The AGI represents a diverse community, constantly evolving. The geographic information industry is indistinct to say the least, but so too is the environment in which the Geospatial Commission has been established and all of us are living and working.

In 1985, the government of the time set up a Committee of Enquiry into the Handling of Geographic Information by computer. Chaired by the late Lord Roger Chorley, the Committee's views were a landmark for geospatial professionals in the UK. The 'Chorley Report' made sixty-four recommendations on the digital use of geographic information; topographic mapping; the availability of disaggregated data; the problems and benefits of linking different data sets together; education, skills and training in our discipline; research and development; the need to increase awareness of geographical information systems (GIS), and the most appropriate role for government in this sector, plus its machinery for co-ordinating government-generated or distributed geographic information.

Among its recommendations, the Report proposed that the government should set-up and support a UK 'Centre for Geographic Information'. The government declined. However, the geographic industry rallied at the suggestion and our Association was formed as a result. Today, the AGI is primarily membership-funded and volunteer-driven by professionals, but our raison d'être has not changed: there is still a pressing need to maximise the use of location data for the benefit of citizens, commerce, and good governance in the UK.

In this light, we are encouraged by the establishment of the Geospatial Commission and its ambition to define a new National Geospatial Strategy for the UK. However, our provenance speaks volumes. There are concerns among our members that government has tried to capitalise on the public sector's geographic information before – without succeeding. This may be due to the 'turning wheels' of successive government. It may be due to the size of the challenge.

As the precursor to, and indication of, work on a new National Geospatial Strategy, some of our members are disappointed by the scope of this Call for Evidence. The emphasis appears to be on working towards a strategy that is optimising the use of data from the Geo6, with a strong focus on traditional GIS applications, rather than opening up the opportunity for significant change in and supported by the sector.

It is our understanding that the Commission wants to ensure the UK is well-equipped for the long-term, so that it may capitalise on opportunities presented by the geospatial data at its disposal. The Commission states that it wants to champion, and help realise, the derivation of maximum social and economic value from that data by driving insight, innovation and investment in geospatial capabilities and technologies across both the public and private sectors. The AGI shares and supports this ambition.

Good governance considers the widest opportunities for using location-oriented data to tackle social, economic and environmental challenges, so that society can make evidence-based decisions to direct resources efficiently and effectively.

For those who are well-acquainted with the government's geospatial information, it is hard to imagine that any part of local or national government would undertake development planning and citizen-focused decision-making without fully optimizing resources at its disposal. And yet that is the case. The awareness of, uptake, ubiquity, and accessibility to location information is still far from optimal.

Our members have a broad consensus that, if the Geospatial Commission is to achieve its stated aims for a National Geospatial Strategy or to be an effective catalyst for that ambition, then a wider profile of work, potential use cases, and cross-sector engagement is necessary.

This Response to the Call for Evidence and the following recommendations were approved by the Council of the Association for Geographic Information[1] following active consultation with our members.

[1] https://www.agi.org.uk/about/council/members

Overview of recommendations:

- that the Geospatial Commission extends its focus and remit to, as a minimum, closely reflect the UN-GGIM Integrated Geospatial Information Framework (Aug. 2018), which has already been adopted by the UK Government as a best practice approach.
- that the Commission's work surfaces a glossary of appropriate definitions and consistent wording – reflecting existing best practice – which can be taken up by the geospatial community and thereby increase comprehension among those unfamiliar with geospatial concepts (Q1);
- to promote and stimulate the development of geospatial information skills beyond Geography as a subject into a part of the general digital skills and STEM curriculum (Q2);
- early implementation of a study into the geospatial skills gap (Q3).
- that Government mandates the collection and sharing of underground asset data, and that this data is made available via an independent body (Q4)
- to consider an approach that maximizes societal return of location-enabled data generated by sensors in autonomous vehicles and similar technologies (Q4).
- to explore in detail the benefits of wider adoption and use of the Unique Property Reference Number (UPRN) or other common identifier of place as the mechanism for linking data (Q5);
- to facilitate wider engagement between the GI and EO practitioner communities, and greater co-ordination to optimise the data available (Q6);
- to create the right conditions for technological advancement and innovation, the uptake of, and maximisation of location data available by the many, rather than to directly stimulate advancement of specific technologies by the few (Q7);
- to recognise that Government's current approach to investment creates significant inefficiencies and a culture where investment is (to) dependent on large government owned players (Q9);
- to recognise that considering simplification and harmonisation of licensing is an imperative element of an effective National Geospatial Strategy (Q12);
- that the Commission supports the AGI Standards Committee work plan, proposing a greater focus on communication of the value and implementation of standards in 2019 (Q12);
- to support the integration of best practices and vocabularies that encourage improved access and sharing of spatial data on the Web as developed by the joint W3C/OGC 'Spatial Data on the Web' Interest Group (Q12);
- that government-generated, spatially-enabled data also made available in an alternative coordinate system such as WGS84 (Q12);
- to support the implementation of the Government Digital Service's existing technical standards for APIs and to encourage API providers to organise formal support for their end users (Q12);

- that the Commission recognises that, as a consequence of the NMA's funding model, we have a less integrated approach to geospatial information than we see in other countries (Q13);
- that the Commission considers additional collective purchasing of private sector data, including speed data and other road attributes (Q14);
- to author procurement guidelines, including applicable standards, use of APIs and the conditions to licensing (Q14);
- to propose a common geospatial policy framework for the UK, including for the devolved matters, based on the UN-GGIM Integrated Geospatial Information Framework (Q15);
- that the Commission builds on existing structures for voluntary regional co-ordination and cooperation to share best practices with the public sector, local private sector and academic partners (Q16);
- to nurture a culture of innovation using geospatial information to enable creation of currently unknown high value opportunities (Q17/18)
- that attention is given to the importance of clear location privacy guidelines, which will form the basis of future trust in our industry (Q19);
- that the opportunities created by the UK's established presence in the international community are adequately funded to support better distribution of existing knowledge among the widest possible community of geospatial information providers and users - and that the Commission's work, developing opportunities for an international presence, is not limited to the "Geo6" (Q20).

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GC Questions || AGI Responses

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

An accurate view is essential in our industry. Our members reflect a need to adapt the language and terminology of geospatial information being used not only by the industry today, but for its beneficiaries tomorrow too.

In general, people often need a dictionary when talking to a geospatial professional. The common terminology of geospatial, geographic information, GIS[2], LBS[3], geodesy, cartography et al can be confusing to many. Like any profession, taxonomy and specialist terminology is vital. But if our industry's ambitions are to unlock the power of location data, then change is imperative in the way we – and the Commission – communicate, too. If 'everything happens somewhere', then 'every word matters'.

Our recommendation is that the Commission's work surfaces a glossary of appropriate definitions and consistent wording – reflecting existing best practice – which can be taken up by the geospatial community and thereby increase comprehension among those unfamiliar with geospatial concepts.

With that in mind, the definition of geospatial data types provided by the Commission seems very traditional and oriented towards the use of geospatial data in traditional "GIS". Our members have responded to "is our view accurate?" by commenting that, as an indication of the Commission's approach to creating a National Geospatial Strategy, this initial focus on geospatial data types does appear to limit the scope of the Call for Evidence. This may simply be an inherent, and very nominal, issue with the order in which these questions were posed in a working document … but the Commission's work should be an opportunity to move away from traditional thinking on its own.

Our members would like to see views of data types and their definitions move towards more innovative concepts and the application or use of location. Digital twins and business intelligence, internet of things and personal medical appliances etc. will all require new ways of applying location information, breaking down the barriers between the different datatypes.

From a geospatial professional's point of view, however, we'd like to make the following remarks:

- **Geospatial data:** Here, we have a reference to "geospatial data", but later on in the document there is also a reference to "core geospatial data". Is that intended to be the same? In documents used by the international geospatial community, we believe this data is often referred to as "Framework Data" or "Reference Data" whilst the UN has adopted the term 'Fundamental Geospatial Data'[4];
- **'Positional data':** This is not a term that's used regularly. A more common term is "thematic data" or "user data". The current definition also doesn't seem to take moving objects into account;
- **Geospatial identifiers:** No comments.

[2] Geographic Information System
[3] Location Based Services
[4] http://ggim.un.org/UNGGIM-wg9/

- **Geospatial services:** The term 'services' is confusing in this context, as the industry most often uses that term for web services and other online methods of data distribution. An alternative term of 'geospatial Intelligence' might be more appropriate.

We are confident that many responses to this Call for Evidence will talk about geospatial language, and the definitions and scope for a new National Geospatial Strategy. We hope that the Commission will embrace an early opportunity to review the wording of its Charter to reflect the outcomes of this Call for Evidence. And as the environment, challenge, and opportunities evolve, we hope that the Charter is couched as a dynamic, evolving framework.

Q2. In addition to current government policy, on what areas of geospatial skills could the commission best focus, to help ensure the necessary capability within the UK for the future?

As an integral part of a new National Geospatial Strategy, there is an urgent need for government to promote and stimulate the development of geospatial information skills beyond Geography as a subject into a part of the general digital skills and STEM curriculum.

In research[5] carried out by Wharton Business School and IHS Markit on behalf of Experian's data literacy project, it's been revealed only 24% of the global workforce feel that they are fully data literate, and only 21% of 16-24 year olds today consider themselves to be data literate.

Over the last 30 years of our industry's evolution, we cannot recall any specific research being done into nationwide geospatial skills' deficits. And yet with an estimated 90% of all jobs in the next 20 years requiring some form of digital knowledge[6], it is imperative for the geospatial skills vacuum to be acknowledged and addressed at the most basic level (primary schools) and subsequent stages of learning, in its own right, and at the earliest opportunity.

If the Geospatial Commission's new National Geospatial Strategy does not aim to bridge the geospatial skills gap at the earliest opportunity, by starting at the most basic levels, then the intimated potential £11bn of economic value will not be achieved.

Our members see the geospatial skills curriculum as an evolving challenge: this work should involve a wide cohort of educators and geospatial specialists empowered to drive a bold agenda ranging from beginner levels of understanding – the principles of location data in decision-making – to advanced levels of awareness and capability.

There are a number of protagonists who are endeavouring to support this approach, and in Northern Ireland for example, our AGI Northern Ireland members are working alongside Esri to explore a presence within secondary schools. However, with the digital skills curriculum being driven by central government, we would urge the Commission to support a strand of nationwide geospatial skills focus at the earliest opportunity.

[5] https://www.experian.co.uk/blogs/latest-thinking/data-and-innovation/experian-and-the-data-literacy-project/
[6] https://www.gov.uk/government/news/adults-to-benefit-from-digital-skills-overhaul

There is a long-standing debate in our industry: should spatial information still be regarded as being 'special'? We believe it should not - technologies have evolved, but education is still primarily addressed in the geography curriculum. Most information users already use geospatial information whether they realise it or not. Integration is ubiquitous.

The use of spatial information extends from specific, specialised use cases (the incorporation of location awareness in business intelligence tools like Tableau[7], for example), to everyday applications such as consumer-focused, location-based phone apps. Smartphones might not present the traditional image of a map to the user in every app, but geospatial information is being used to deliver functionality: finding which films are playing in your neighbourhood, for example.

The Commission would benefit from considering the ramifications and extent of, and consider the skills landscape against, this backdrop of ubiquity today – and how that's manifesting itself in the workplace. There is a pressing need to catch-up. Acute geospatial awareness needs to be promoted from the highest level, in both the public and private sector, demonstrating and facilitating the application of location data.

On the one hand, it is imperative that the development of 'traditional' geographic information-related skills is given the support it needs – our members spoke about geodesy and surveying, cartography and geographic information systems' use and management, in particular. These are the necessary skills for using and producing geospatial information; planning; understanding and managing the environment; managing assets effectively and carrying out a panacea of location-based tasks.

But on the other, many members stated their colleagues would "rather recruit a data analyst or computer scientist with a basic understanding of location, than a GIS specialist". Too often, it was felt that – even though fresh GIS graduates might be proficient as users of GI tools – there is a lack of proficiency in more general data management and data analytics: there is a danger that, in the surge towards "making better use of data in general", the true value and potential for location data may be lost.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

To answer this question, we have also consulted, and worked with, RGS-IBG with whom we have a strategic partnership and a programme of ongoing work, specifically focused on skills.

The primary gap identified is the availability of computer scientists, software engineers and data analysts who have sufficient knowledge of geospatial concepts and geospatial data. During our discussions, members told us that even 'traditional' geo-teams embedded in an organisation find it hard to stay abreast of the latest technological developments in their own field – or to make that information widely and easily available to their colleagues – and yet it's those self-same developments that could provide the greatest development potential and productivity gains for their organisations.

The secondary gap is a vacuum of knowledge. In every area of policy-making, there needs to be a much better understanding of location analysis concepts. Not only in terms of the rich analysis and more informed

[7] https://www.tableau.com/

decision-making that's possible with geographic information, but also in terms of the multi-faceted implications that may be surfaced in the process – such as ownership of data, and the ethics of using location data that's related to individuals: their personal privacy, in particular.

The AGI would strongly support early implementation of a study into the geospatial skills gap specifically (as opposed to the digital skills gap in general) in both the public and private sector. This would enable the Commission to better understand the gap between current approaches to workplace problem solving; current employee comprehension and skill sets, and the comprehension and skills necessary to exploit location data to the full.

The AGI welcomes the inclusion of Geography in the Government Science and Engineering Profession and recognise the importance for development of geospatial careers. However, geospatial information doesn't only apply to Geographers; we also need to promote geospatial information careers to the Digital, Data and Technology Profession[8].

In terms of careers per se, there is currently little if any promotion of 'geospatial as a career' within the learning environment. Teaching resources are limited. The current cohort of careers advisers, both inside and outside mainstream education, cannot promote careers in our sector – because they have not had sufficient exposure to the many diverse dynamics of our discipline. As a bare minimum, it is **our recommendation that the government's National Careers Service (and Scottish, Welsh and Northern Irish equivalents) be updated to a) better reflect the diversity of roles available, and b) better describe the skills, tasks, and aptitudes involved – and that this information be expanded and cascaded throughout the education system.**

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this is of value, how access/quality could be improved?

In our answer to question 12 we will discuss the generic issues with access to publicly and privately held geospatial data.

Our membership is diverse. Their views on targeting datasets are naturally linked to their own or their organisations' own objectives. Three types of data were focal points:

1. Geographic identifiers: the UK needs a persistent framework of suitable location data identifiers that can link datasets and data to the real world. Currently, the most common example of such a framework is our combination of well-established addresses, postcodes, and Unique Property / Street Reference Numbers (see also Q5), but these identifiers are not made freely available to data users. This stifles productivity. It inhibits economic growth. And it means that citizens are not receiving joined-up public services.

[8] https://www.gov.uk/government/organisations/digital-data-and-technology-profession

We recognise that the Commission has already made a commitment to explore which identifiers are being used by its geospatial protagonists, and whether or not any other identifiers would be appropriate: we understand the focus is on land and property-related 'unlocks', initially. But it is vital to remember that, while this question focuses on increasing access to geospatial datasets in particular, there are many other public datasets providing records at address level.

Many of those datasets do not use unique identifiers for those addresses – which means they are not as efficient as they could be, and that inaccuracies and effort are being duplicated – and any future activity, by the government, exploring improvements to public services, would benefit from considering location data identifiers from the outset.

2. Data about underground assets, specifically: as a holistic exercise in improving national productivity and citizens' welfare, the UK would benefit from improvements to the way that information about underground asset data is shared. Gas; water; sewerage; electric; telecoms installations etc.

   With this data to hand, local authorities, planners, developers and others could model the impact of work on and for new and existing infrastructure. This would lead to significant savings in both the public and the private sector. **Our recommendation is that the government mandates the collection and sharing of underground asset data, according to PAS256 / similar standards, and that this data is made available via an independent body** (thus negating the 'who owns the data', 'license the data' discussions).

3. Data generated by sensors: The developments in autonomous vehicles, the improvements in telecoms connectivity (5G), the Internet of Things, and other sensor networks will deliver vast quantities of location-enabled data.

   Over time, this data could become a primary resource for the UK, about its built environment. It is clear that projected scalability needs to be considered on a level never before attempted, and it is clear that it would not be in the public interest for either a few private sector platform providers or for the National Mapping Authorities on their own or a combination of the Geo6 to have ownership of this data.

   By way of example in achieving this, in the Netherlands[9], the city of Eindhoven prevailed in this situation by developing a Charter[10] with private sector partners to ensure that all societal players can benefit from such an achievement.

[9] The Netherlands is used as an international comparator in our response as just one example of international practise from which UK might learn

[10] https://www.eindhoven.nl/sites/default/files/2018-01/Smart%20Society%20IoT%20charter%20Eindhoven%20v01.pdf

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The UK's current addressing and postcode system serves three purposes, at least. This combination of factors makes it challenging to change the current system – to support emerging technologies – or to adopt an alternative. But this does not mean that we could not improve the status quo.

- Our current system acts as a human-readable description of a location;
- It serves as a geospatial identifier for linking the individuality of that location in one dataset to another (or to services, or between datasets and services themselves);
- And in its current form, unlike other countries with more strictly-organised addressing systems, UK addressing has an important cultural attachment for citizens.

In their most basic form, addresses play the essential role in linking a single source to a location point: that might be household goods moving from a warehouse to a home, or an ambulance leaving its depot to make an emergency call. In our open sessions, members highlighted significant friction in the current address ecosystem:

- ownership of authoritative address data is divided between the private and public sector;
- incomplete implementation of addressing at national and local levels leaves many objects "unaddressed";
- there's a margin of inconsistency cross the myriad Gazetteers;
- the BS7666 addressing standard is complex;
- pricing is a barrier for some and licensing is a barrier for many.

The significance of the last point should not be underestimated. In particular, last-mile delivery services and other consumer-focused providers are content to use address data from a free or even outdated source if that brings down costs.

If addressing data is inaccurate, or not accurate enough, then this leads to increases in traffic on local roads that increases costs and congestion. It also increases risks to public safety – the emergency services have, to a lesser extent, been seen adopting the same commercially-focused approach – and to the environment. Inefficient routing is a direct cause of greater pollution.

Some of our members suggested the development of an open system of ubiquitous, unique identifiers at a much more granular level, for all locations, which would deliver significant benefits to the economy. Such a system of unique identifiers could be based on (and extend) the Unique Property Reference Number curated by GeoPlace, and act as the linking mechanism between locations and datasets or services.

As an analogy, the identifier acts like a spatial National Insurance Number, which many organisations use without having to share personal details. The UPRN could become the identifier that is exchanged without the need to exchange the – personal – address.

In a granular form, we believe these identifiers could then support several iterations of innovation in technology, such as machine to machine communication and beyond.

Of course, such a system would still need to meet the criteria for being easily read, remembered, and understood by humans.

Our recommendation is to explore in detail the benefits of wider adoption and use of the Unique Property Reference Number (UPRN) or other common identifier of place as the mechanism for linking data.

A good example of the value of this is the 'Key Registers' approach in the Netherlands[11].

Q6: How should the commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

We are encouraged by the development of the UK's Earth Observation (EO) industry and data market, as stimulated by (among others) UK Space, Innovate UK and the Satellite Applications Catapult. We welcomed the London Economics paper[12], which identified the value of satellite-derived EO for government applications alone as being in the region of £943 million per annum and rising.

However, EO is not a panacea: it detects change over large areas, often more quickly and more cheaply than other methods, and it is true that better and more widespread use of EO data may enhance public service delivery even as potential risks mount and departmental resources shrink (it can also provide the information needed to support interventions by non-government actors) – but it is not a useful resource unless it is calibrated with "in-situ" data and integrated with other information, by people who can understand that data, and interpret it accurately. That requires skill. Unless EO knowledge is disseminated effectively, EO is at risk of not achieving its true potential.

There are implications for our industry – and our industry's beneficiaries – from not only the potential changes to Sentinel data access in the short term, but also from the lack of long-term clarity on how value will continue to be derived from EO use in areas driven by compliance with EU legislation.

Our community points towards the recent London Economics report as a response to this question but, in essence, to support an effective market, **we recommend wider engagement between the GI and EO practitioner communities, and greater co-ordination to optimise the data available.**

[11] https://www.elra.eu/authentic-registers-in-the-netherlands/
[12] https://londoneconomics.co.uk/wp-content/uploads/2018/07/LE-IUK-Value-of-EO-to-UK-Government-FINAL-forWeb.pdf

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Our membership was concerned by the idea that the Commission would consider becoming involved in specific technologies, or indeed, in promoting the involvement of any one of the Geo6 in exploring one or more avenues of technological advancement in particular. The main concern was that such investments could remove competition from other private or public sector bodies who may be better placed to deliver similar if not better technologies in a more efficient way.

It is more important to create the right conditions for technological advancement and innovation, the uptake of, and maximisation of location data available by the many, rather than to directly stimulate advancement of specific technologies by the few.

That said, in the main, our members cite the widely-recognised technologies as being the sources for new opportunities that will deliver economic growth.

Artificial Intelligence permeation and Machine Learning for processing geospatial data; UAVs[13]; a variety of sensors for capturing data; autonomous transport; personal sensors; BIM[14]; Digital Twins as representations of the real world; digital crypto technologies (blockchain et al) for storing and processing authoritative data – these are not new.

But there are numerous technologies under development that will have location elements in them by default. Many of these technologies will widen the scope of geospatial information in areas that have not been explored before.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The application of geospatial information in the roll-out of emerging technologies is well known. BIM and Digital Twin concepts support the Smart City; precise location and lidar scanning support the autonomous vehicle; detailed surveying may be the solution to roll-out new communication technologies such as 5G. These uses of geospatial information are intrinsic to the problem.

The specific use of geospatial information in the roll-out of established technologies is still sometimes overseen. Roll-out of smart meters is dependent on the building geometry, whereas roll-out of broadband, solar and wind energy require a strong understanding of the local geography.

Some of our members stated that too often these developments are focused on cities, and that the rural environment sees equally interesting – albeit different – opportunities with emerging technologies like precision farming.

The industry will need to ensure that basic geospatial and location skills are developed among the inventors of tomorrow, so that location is not seen as an add-on to a new technology, but embedded in it.

[13] Unmanned Aerial Vehicles
[14] Building Information Modeling

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The AGI membership interpreted the question in two different ways: (A) "how to invest" and (B) "what to invest in".

A. Investment methodology: the AGI membership confirms the importance of a long-term commitment to the maintenance and revision of and investment in geospatial data assets. The unique position of the UK regarding its market-driven financing of national geospatial databases and the national positioning infrastructure is seen by members as a help and hindrance for unlocking the value of geospatial information.

   Some members appreciate the opportunities created by market-driven financing where they state that it creates independence of national budgeting cycles and supports significant investment budgets.

   Other members stated that this approach to investment creates significant inefficiencies (most funding is from Government anyway) and a culture where investment is (to) dependent on large government owned players.

   In this regard it is perhaps worth noting that an extensive study[15] by UN Member States' national experts concluded that 'designing and implementing national institutional arrangements is a complex undertaking, and that there is no single universal solution or model'.

B. Regarding the specific investment directions, the membership focuses mainly on interoperability, usability and access, underpinned by market requirements. These considerations have been discussed in our answer to Q4.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Positioning technologies are a crucial component of the national infrastructure, supporting – but not limited to – airspace safety (UAVs, planes), smarter car and HGV navigation (including autonomous vehicles), reduction of congestion and pollution, consumer communication, leisure and social activities, sensor networks and many more applications. Government should consider making the underlying infrastructure openly available to all, in real-time.

The AGI is especially encouraged by the EU Galileo initiative, the newest generation global navigation satellite system which will be a game changer for the accuracy of positioning. The AGI would encourage

[15] Compendium of good practices for national institutional arrangements: http://ggim.un.org/meetings/GGIM-committee/7th-Session/documents/Agenda%207%20Compendium%20of%20NIA%20Good%20Practices.pdf

Government to maintain the ties to the Galileo programme after Brexit, since it can not independently develop this capability.

As applications of geospatial information become more global – and to support the Commission's global ambitions – AGI Council recommends that Government should consider explicitly connecting the UK's geodetic framework to the Global Geodetic Reference Frame[16], as adopted by the UN General Assembly in February 2015. Government should also consider (positional) interoperability of datasets provided by various Government agencies in the UK, beyond the Commissions Partner Bodies. Most specifically interoperability with datasets from Northern Ireland is an issue for some of the AGI's members.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Our membership highlighted that it currently perceives tangible inefficiencies: private sector surveyors are collecting data during construction or conveyancing and government agencies are collecting that data or similar data again. There are clearly commercial sensitivities in play and the issues of quality, accuracy, currency, ownership, privacy etc should all be considered. But our members would very much like government geospatial data agencies to be more open, more receptive to, and responsive about input from the private sector.

The Marine Environmental Data and Information Network (MEDIN[17]), allows stakeholders in the public and private sector to submit data to its repositories, whereas in many European countries, e.g. Denmark[18] licensed private surveyors contribute directly to national mapping.

AGI members were positive about the engagement undertaken by Ordnance Survey around definition of its public task. These processes are important for all public sector information providers to inform them whether data they collect is still valuable or if it is better to focus investment elsewhere. However, it is also important that there is clarity and visibility of the follow-up to this process and that the private sector has similar access into the process and its outcomes.

Regarding the geodetic network, the AGI supports the statement made by RICS that "The private sector has a role to play when 'densification' of a network is required, however ultimate responsibility and therefore liability remains with state agencies. The geodetic network (and related activities) are of national significance: private firms can engage in the provision of GNSS enhanced data services (Real Time Kinematic, RTK) as is currently available."

[16] http://ggim.un.org/UNGGIM-wg1/
[17] (http://www.oceannet.org)
[18] https://www.fig.net/organisation/council/council_2007-2010/council_members/enemark_papers/dublin_november_2005.pdf

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

In many cases, price is not the primary barrier to using government [public sector] geospatial datasets. Data exists on a spectrum, ranging from closed, to shared, to open. In many projects, the tangible cost of datasets or parts of those datasets may be only a few per cent of a total project's value. There is certainly no consensus among our members that 'make it free' is the default answer for improving access to location data.

Our members face challenges in 5 areas:

- Licensing
- Interoperability
- Discoverability
- Operational barriers
- Geospatial peculiarities

Licensing

"Licensing is now a skill in the GIS analyst's skillset", is something we heard multiple times; the implication being that GIS analysts today must also develop an onerous, in-depth understanding of the complex and diverse licensing models they're dealing with, before they can use the data. It should be noted that this challenge also exists when using open data, more so if different open data licenses are combined.

Our members need data-rights and associated licensing to be interoperable and clear, in both the private and public sector. This is imperative if datasets are to be combined and re-used without having to be a licensing specialist. Simplification and harmonisation are essential. Our members also emphasise that facilitating the re-use and commercialisation of public data by virtue of those licenses is important.

If, for example, a public sector body wants to use location data in a dataset that turns out to be attractive for, say, the pharmaceutical sector, then the public sector body might have an opportunity to recover the cost of enriching the data. However, currently, the public sector is prohibited from doing so under the terms of the One Scotland Mapping Agreement (OSMA) and the Public Sector Mapping Agreement (PSMA).

We recognise that the Commission has made a commitment to understand what licensing exists, which commonalities that licensing shares, what the differences are, what the impact of licensing constraints are and the relationships with third party intellectual property, and whether or not licensing can be simplified and harmonised – right across the Geo6. AGI welcome this news and supports the need to do so.

It is evident that our members consider the simplification and harmonisation of licensing to be an imperative element of an effective National Geospatial Strategy.

Interoperability

Members stated that there is a greater need to ensure technical interoperability between datasets. This interoperability would be promoted by a greater focus on technical standards with associated implementation guidelines, as well as the introduction of best practices and domain specific standards in areas such as planning. Significant strides have already been made through the implementation of INSPIRE[19], but too often, standards are still seen as a burden rather than as necessity to support collaboration.

The AGI provides the secretariat and enables the expert group for IST/36 – the BSI (British Standards Institution)'s technical committee for geographic information – thus also known as the AGI Standards Committee. The AGI Standards Committee manages 86 live standards, with 46 withdrawn, and 47 in progress projects. It is connected to various ISO committees related to Geospatial, primarily to ISO Technical Committee 211, while a number of the standards originate in the Open Geospatial Consortium[20] (OGC). As geospatial is relevant to so many domains there are many other relevant standards from other ISO committees, W3C, ITU, buildingSMART, SISO, IHO, WMO and others. Whilst these all have a different scope, collectively they form the global standards ecosystem that the geospatial community relies on to collect, maintain, discover and share geospatial data.

Through our Standards Committee work plan for 2019, we are proposing a greater focus on communication of the value and implementation of standards in 2019. We recommend that the Geospatial Commission supports this work.

To this end, and to support this response, our AGI Standards Committee organised a workshop, dedicated to this Call for Evidence. We recommend that the Geospatial Commission take note of AGI's Standards Committee's conclusions[21]:

1. Organisations delivering into the most regulated environments had the most mature use of standards, i.e. Met Office, MoD and Hydrographic Office – especially as they operate in a global environment where interoperability with other national and international agencies was imperative;
2. In organisations with long experience of dealing with data dissemination to a wider business and consumer market, such as OS and also BGS, the adoption of standards has often been driven by the need to provide data in the form in which it can be used by systems and in applications available to users;
3. Until recently, organisations established to perform one main function (HMLR, Coal Authority, VOA) have been inward looking but are increasingly having to present their data in forms that can satisfy widening needs of their users;
4. Many of the organisations are having to confront the problem of how they can better utilise their data internally. In the past, there has been a proliferation of data silos, each meeting an internal need without consideration of the wider pan-organisational requirement for sharing and interoperability. Examples of

[19] https://guidance.data.gov.uk/inspire.html
[20] http://www.opengeospatial.org
[21] https://www.agi.org.uk/about/resources/category/80-standards-group?download=343:standards-committee-minutes-21-sep-2018

where this has happened are Defra, MoD and the Coal Authority; using open standards can help here too;

5. The published standards are the basis for implementation within an organisation, but a lot of work is needed to interpret those standards and develop instructions and codes of practice specific to the needs of the organisation whilst maintaining conformity with the standards and enabling interoperability externally. People need to be trained in the instructions and codes of practice. This was exemplified in the presentation by MoD;
6. It is clear that some standards have a wider currency. These included those established by the European Commission INSPIRE initiative (led in the UK by Defra): the ISO metadata standards, particularly the UK interpretation of it as GEMINI2, and the standards for Web Feature and Map Services. The British Standard BS 7666 is widely used for land and property."

Discoverability

Many members stated that geospatial data in the public sector is hard to find. The data.gov.uk platform and others are still a collection of data without curation. This does not give developers a clear understanding about what is 'good' data, whether or not the datasets are the most current versions, or even if they are still available. This is making it hard for developers to use that data, in and outside the traditional geospatial industry, which is stifling innovation and growth.

We recognise that the Commission has already made a commitment to Data Discovery: exposing the breadth and depth of data available among the Geo6 as opposed to or as well as their products and services and content … as well as exploring whether or not the source data therein could be made more accessible and, if so, how.

The joint W3C/OGC 'Spatial Data on the Web' Interest Group[22] maintains a set of best practices and vocabularies that encourage improved access and sharing of spatial data on the Web. The AGI – through the AGI Standards Committee – manages the GEMINI[23] standard for geospatial metadata. That standard is playing an important role in discoverability of data. **We recommend that, without needing to reinvent the wheel, the Commission supports the integration of those best practices**, **within the National Geospatial Strategy**.

Geospatial peculiarities

Geospatial data has inherent peculiarities. Many mainstream developers do not have the necessary experience with geospatial data. If government-generated data is not easy to use, then people will choose to use alternative data of inferior quality or authenticity, which could lead to inferior applications or decision-making. Coordinate systems and projections are hard to grasp for developers. Our members would like to see government-generated, spatially-enabled data also made available in an alternative coordinate system such as WGS84[24].

[22] https://www.w3.org/TR/sdw-bp/#indexable-by-search-engines
[23] https://www.agi.org.uk/agi-groups/standards-committee/uk-gemini
[24] https://en.wikipedia.org/wiki/World_Geodetic_System

Operational barriers

Several datasets are available as cloud-based services and APIs. The increase in this trend has been promoted through the INSPIRE programme, among others. Yet there is a barrier to usability with these services: the lack of formal support by the API suppliers in government and of technology supplier. This is a significant barrier to uptake for businesses and critical applications that are dependent on those API's.

We recommend that the Geospatial Commission supports the implementation of the Government Digital Service's existing technical standards for APIs[25] and encourages API providers to organise formal support for their end users: this would also facilitate valuable learnings in terms of feedback from the user-centric forum.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

This is a complex issue. The UK's governance and operational structures of national mapping and land registration are complex, with two National Mapping Agencies (OS and OSNI) and three land registries (HMLR, RoS and LPS). Also, some responsibilities that are internationally typically held by the NMA are vested in yet another department (INSPIRE and its associated data distribution responsibilities). With the AGI's membership across all four nations, they will have a very different experience in each nation.

Our response here is a summation but, while this is a broad consensus, we would not want to suggest the views expressed in this answer are all-encompassing. To provide that level of response, members would want to explore, surface and offer evidence in much greater depth than this consultation affords – and we hope that the Geospatial Commission will extend this area far beyond the remit of this Call for Evidence. Initially, however, we can proffer the views collated during our round tables and sessions over the last two months, and the feedback we've been receiving over the last couple of years.

AGI members are encouraged that the Commission has taken responsibility for the PSMA and Aerial Imagery contracts on behalf of Government. Our members place significant importance on the long-term commitment, by government, to the maintenance, revision of, and investment in national geospatial data assets. Many of our members state that it needs to be the Commission's role, to act as a customer and to use transparent, visible processes to ensure that this is a shared conversation amongst the public sector providers, holding those providers to account. The current PSMA and OSMA contracts are a good step in that direction.

However, many of the members expressed that the current operating model of some of the providers is as much a hindrance as it is a help towards growth of the geospatial industry. In most discussions about this question, our members focused on the business model of the National Mapping Agency for Great Britain.

Ordnance Survey's model is unique. Our national geospatial databases and national positioning infrastructure are the responsibility of an organisation that was encumbered with a dual purpose: a) to deliver services for the public good, and b) to maintain a commercial focus so that it can provide a dividend

[25] https://www.gov.uk/guidance/gds-api-technical-and-data-standards

back to government. Intrinsically, this creates conflicts of interest and surfaces inherent challenges to unlocking the value of location data.

Some members appreciate the opportunities that arise as the result of a market-driven financing model: their focus may be on research and innovation, and, with significant resources at its disposal, OS is a definitive exemplar of the commitment necessary to stimulate growth using location data. We should recognise, and applaud, the world-class reputation that OS has delivered for the nation. The model also affords an independence of national budgeting cycles and provides reassurance in many quarters as to national security and stability.

However, some members state that this model creates:

- inefficiencies that have a bearing on the public purse;
- an environment that's too dependent on government input;
- a 'closed loop' of internal governance that is not transparent;
- a subjective view on what is best for the nations it serves;
- a less integrated approach to geospatial information than we see in other countries;
- a silo of expertise that cannot provide impartial guidance to government, and,
- a conflict of intent that is not in the national interest.

Some of our members stated that the situation would potentially be ameliorated if there was no pressure on the organisation to deliver a dividend: in that case, its work would be focused on serving the public task[26]. In the course of delivering an optimal arrangement for the Geo6, some of our members would encourage the Geospatial Commission to consider this situation in the round.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As has been stated in Q,12, many members stated that geospatial data in the public sector is hard to find. The data.gov.uk platform and others are still a collection of data without curation – and the metadata, defining what is in those datasets, may be less than optimal. This makes it harder to define which additional geospatial datasets might be pertinent.

However, in the round, the Commission should consider additional collective purchasing of private sector data and defining policies for data collected by sensors (see Q4). The examples given by various members are speed data, plus other highway-associated attributes that have been curated by companies like Here, Tomtom, and Google.

[26] https://www.ordnancesurvey.co.uk/about/governance/public-task.html

For data and services that the Commission could not collectively purchase, our members recommend that the Commission considers its place to author procurement guidelines, which would include reference to applicable standards, the use of APIs, and the conditions to licensing[27].

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Members have commented on the limited scope of the Call for Evidence and the apparent emphasis on data provision. To deliver a sustainable, effective National Geospatial Strategy for the UK, we recommend that the Geospatial Commission extends its focus and remit.

The AGI has worked across the UK to support and challenge strategies in devolved administrations. At this moment, the Scottish Government is developing a geospatial strategy to succeed the One Scotland One Geography[28] strategy. There is a risk that devolved strategies will not be aligned.

The Commission should propose a common policy framework for the UK that includes the devolved matters. The AGI recommends that, as a neutral, internationally accepted framework, the Commission should adopt the UN-GGIM Integrated Geospatial Information Framework[29] (Aug. 2018), which has already been adopted by HM Government as a best practice approach.

That approach would provide every layer of government with a structure that ensures alignment, without compromising authority that has been delegated or devolved to other levels of government.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

During our events, members from our local government communities have been expressing their concerns about the chronic underfunding of geospatial resources at the local government level. They were especially concerned about the effect on critical local services and responses to emergencies. This underfunding also has national implications, by impacting the quality of addressing services.

The AGI National Groups in Scotland (with the Improvement Service), Wales and Northern Ireland already facilitate voluntary regional co-ordination and peer-to-peer knowledge sharing**. The AGI recommends that the Commission builds on these existing structures to share best practices with the public sector, but also with local private sector and academic partners.**

The AGI is an organisation that is primarily membership-funded and volunteer-driven by professionals. Over the last 30 years, the AGI has not received any structural funding from central government, albeit funding

[27] https://www.gov.uk/guidance/public-sector-procurement-policy#procurement-policies-for-technology
[28] https://www.gov.scot/Publications/2005/08/31114408/44098
[29] http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part 1-IGIF-Overarching-Strategic-Framework-24July2018.pdf

was made available by government departments to support specific projects (GI Gateway, Gemini). In the current climate, volunteers are hard-pressed to secure memberships from individual and corporate memberships into an organisation that, predominately, exists to service the public good.

While the devolved chapters have active cohorts, it is fair to say that the AGI's progress in England has been limited recently due to a lack of resources and a stronger presence of central government players (including the Geo6) – which does not necessarily bridge the capability gap between the private and public sector or academia.

The AGI's workplan for 2019 has an ambition to re-establish regional groups in England, modelled after the experiences in Scotland, Wales and Northern Ireland.

We would welcome the Geospatial Commission's support.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The AGI membership is diverse. As such, the feedback we received about the importance of the first four categories was almost equally split (see Annex 2), albeit their interpretation was sometimes quite different. Where the category "natural resources" might mean tourism for some, for others it would refer to agricultural subsidies or fracking. Additional clarity would be required before committing to specific categories. When discussing these sectors, many of our members were convinced that improving skills and reducing barriers to access to data would already significantly improve the potential in each of these – but also in many other categories.

Some of our members shared the view that, by focusing on known high-value categories, there is a risk that many unquantified or 'less obvious' yet equally high-value opportunities might be missed. A strong focus on "high value" might also be translated to "direct economic benefit" by some, risking progress in areas that focus on wider societal benefit and social need. An example that was mentioned that the use of geospatial information to better plan breast cancer screenings primarily leads to improvements in care, with eventual downstream economic benefits.

We need to promote a culture of innovation, using geospatial information, to surface the potential of these opportunities. The Geovation programme[30] takes a leading approach to enable this type of innovation. **The AGI recommends that this approach is encouraged and supported, and others are explored. Furthermore, AGI recommends a collation of international case studies to confirm other high value categories for prioritisation.**

Q18: Are there any other areas that we should look at as a priority?

It is hard to sufficiently emphasise the importance of taking a ubiquitous approach to the adoption and use of location data. While it is clear that government (and the Commission, per se) must start somewhere, there may be a case for establishing a 'rolling review' of priorities. However, some other key potential priorities were volunteered by our members. These include:

Healthcare:

- the wide-spread use of location data would deliver more efficient planning, lower costs, and higher standards of care across both the national and private health care services;
- through the greater use of location-enabled personal health devices for conditions that are location or weather dependent (such as allergies or air-pollution-related illnesses), we would see improvements in the personal health of individuals – which would have a knock-on effect on lowering costs to the national health service.

Service Delivery:

- location-enabled customer-supplier engagement in new business models (i.e. Uber, AirBnB, Deliveroo, Tinder…);
- increased efficiency of last-mile delivery systems (i.e. Amazon…);
- production efficiency and support of just-in-time delivery (automotive industry, food distribution…)

Financial services:

- in banking, insurance and other financial services, location data has an increasingly important role to play in not only customer analytics, but also in risk management and risk analysis: the provisioning of services to the public, and the risks to insured assets. As the financial capital of the world, the UK has excellent opportunities to combine "GeoTech" and "FinTech".

Environment:

- location data has the potential to effect transition to more-sustainable energy models: better understanding of the proximity opportunities of supply and demand of energy

[30] https://geovation.uk/

Agriculture:

- location-enabled precision farming could increase the yield of crops by up to 25%; it could increase arable farming revenues by up to 40% and reduce production costs by as much as 60%.

Consumer services:

- more than 50% of internet traffic is mobile and most mobile devices are location-enabled. This releases enormous potential for location-enabled apps, games and services to interact with the real world.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Most private and public sector innovations rely on the use of geospatial information. Our answer to Q18 gave a number of examples of these innovations.

Regulatory, organisational and cultural challenges are often stated as the reason why certain datasets can not be released. There is:

- a concern that data may be misused or interpreted incorrectly (fear for liability);
- a fear that shortcomings in the data may reflect badly on the organisation (concern about quality and currency);
- a concern that someone will reengineer data to get access to personal information;
- the possibility that staff don't know how to release data correctly;
- a fear of being sued if sensitive data is release inadvertently;
- the authority to release or not to release data is specified under several acts or regulations – and it is not clear which to apply, e.g. Open Data policy vs privacy, surveillance, record keeping, or Freedom of Information regulations
- the concern that data is not ready for public consumption and agencies don't have time or funding/investment capital to get data ready for public release;
- the concern that open data portals may be subject to hacking and put internal IT systems at risk;
- the concern about the sustainable funding and therefore continuity of availability of data.

Location privacy was mentioned by several members as a significant potential challenge to new innovations. **The AGI recommends that attention is given to the importance of clear location privacy guidelines, which will provide greater confidence in our industry in the future.**

Q20: How best can we make the UK's presence in the international geospatial world more visible?

As one of the founding members of UN-GGIM and with significant presence in many international professional and trade bodies, such as OGC[31], ISO[32], FIG[33], ISPRS[34], EuroGeographics[35], the UK is well placed to learn from international comparators and uniquely placed to export its knowledge and experience internationally.

The AGI is a cross-sector industry body, representing not only the public and private sector, but also the third sector; academia; and private individuals. **We recommend that the opportunities created by this established presence are adequately funded to support better distribution of this knowledge among the widest possible community of geospatial information providers and users - and that the Commission's work, developing opportunities for an international presence, not be limited to the "Geo6".**

The UK has been a strong contributor to the development of the UN-GGIM Integrated Geospatial Information Framework, the global statistical-geospatial framework as a standard for the integration of statistical and geospatial information, and the development of geospatial monitoring of Sustainable Development Goals Indicators. However, the UK has not always internally embraced these same principles, which weakens its expert position.

Challenges such as Brexit and the changing UK role in international programmes such as INSPIRE, Copernicus and Galileo will need to be addressed urgently for the UK not to lose its competitive advantage.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In a study performed by Eurogeographics (an independent international not-for-profit organisation representing Europe's National Mapping, Cadastral and Land Registration Authorities) in 2017, it has been suggested that the funding and governance model of Ordnance Survey is unique among its European counterparts. Other National Mapping Agencies are fully funded or primarily funded directly from central budgets or land registration (cadastral) income - and as a consequence, have been able to adopt more liberal open data policies.

As a consequence of the funding model of the UK's NMAs, we have a less integrated government approach to geospatial information than in other countries. This is delivering inefficiencies to the public purse.

[31] https://www.opengeospatial.org/
[32] https://www.iso.org/
[33] http://www.fig.net/
[34] http://www.isprs.org/
[35] https://eurogeographics.org/

The following international examples provide points of comparison on specific topics:

Mexico: Mexico has merged the management of national geospatial and statistical information into one agency INEGI (National Institute of Statistics and Geography, supporting a government mandate for evidence-based decision making.

Denmark: the Danish Agency for Data Supply and Efficiency[36] is a central point that provides Denmark's geospatial data to the public and private sector. The Agency also provides a Register of Underground Cable Owners ("the place where excavators find information on who owns utility cables underground") and information for professional surveyors.

Netherlands: the Netherlands sees a strong collaboration in the development of standards and best practices through the establishment of Geonovum[37], a Government sponsored not-for-profit.

Belgium: the Belgian National Geographic Institute[38] is establishing a data brokerage function, to support collective procurement by the different levels of government of private sector data.

[36] https://eng.sdfe.dk
[37] https://www.geonovum.nl
[38] http://www.ngi.be/FR/FR0.shtm

Annex 1: Named contributors to the AGI's response

The AGI response to the call for evidence was approved by the AGI Council[39]:

Abigail Page (AGI Chair), EuroGeographics
Alison Wilson, Ordnance Survey of Northern Ireland
Chris Chambers, Ordnance Survey
Dave Lovell, Individual
Denise McKenzie, Open Geospatial Consortium (OGC)
James Cutler, emapsite
Katherine Smyth, Land & Property Services
Lizzie Stutchbury, Informed Solutions
Matthew Pennells, Esri
Merryn Henderson, Rentaquill Ltd.
Morgan Commins, Ceredigion County Council
Tim Marston, CARTO

The content of the submission was collated on behalf of the AGI by Peter ter Haar (an independent consultant), based on a wide number of discussions and events in September and October 2018.

The following attendees to these events and discussions have given consent to add their name to the list of contributors. We did not record lists of participants for the larger events and some other contributors withheld their name on request of their employer:

Anthony Mills, Verisk Geoinformation
Bruce Gittings, University of Edinburgh
Christine Brown, Buccleuch Estates
David McChesney, The Crown Estate
Diana Murray, independent
Elisabeth Stutchbury, Informed Solutions
Freya Muir, University of Glasgow, School of Geographical and Earth Sciences
Gary Donaldson, Millar & Bryce (part of Landmark Information Group)
Gary Gale, Envitia
Gideon Simons, Arcadis
Helen Kerr, Crown Estate Scotland
Iain Paton, Improvement Service
James Cutler, emapsite
James Reid, EDINA, University of Edinburgh
John Murray, Fusion Data Science Limited and University of Liverpool
Jonathan Cameron, NHS
Karen R. Nickel, Wigan Council
Liam Mason, Marine Scotland (Scottish Government)
Michael Groves, Topolytics
Nick Austin, Deloitte LLP
Raquel Martin, Sweco UK Ltd
Shona Nicol, The Scottish Government
Tim Foster, Open Street Map
Tricia Couper, National Records of Scotland

[39] https://www.agi.org.uk/about/council/members

Annex 2: AGI Events supporting the Call for Evidence

The AGI organised a number of events to gain insight from its members, supporting the call for evidence. In total over 165 participants attended six events organised by the AGI:

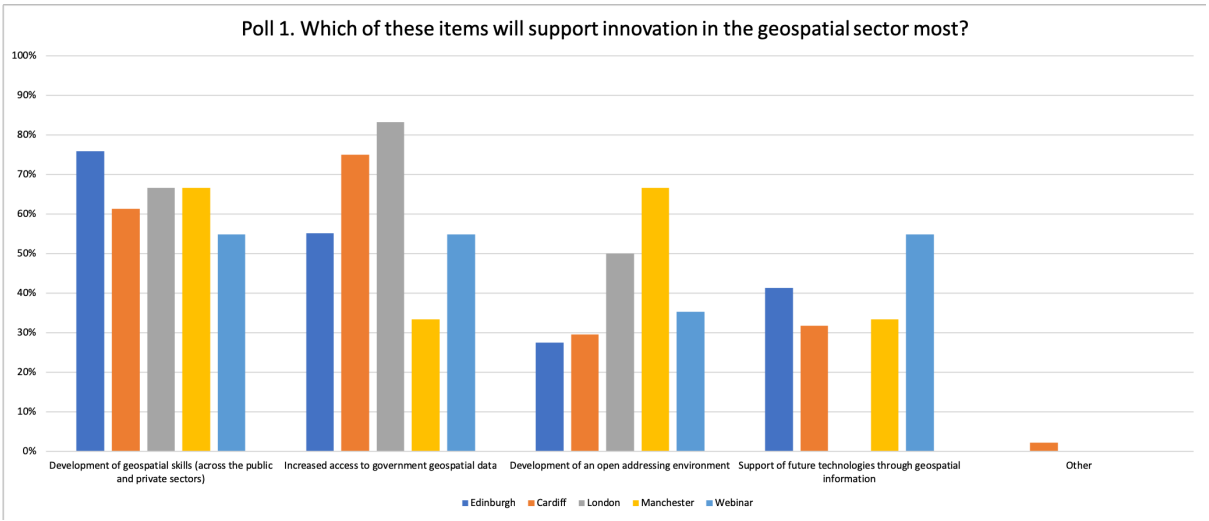
- AGI Standards Committee, 21 September
- Edinburgh (with Scottish Government), 24 September
- Cardiff, 5 October (during the AGI Cymru conference)
- London, 8 October
- Manchester (Altrincham), 10 October
- Online Webinar: 19 October

AGI representatives also participated in other events:

- Belfast (organised by Cabinet Office and Land and Property Services NI), 15 October
- London (a specific skills focused event, organised by Cabinet Office and URUP), 17 October
- Various PSMA focused events

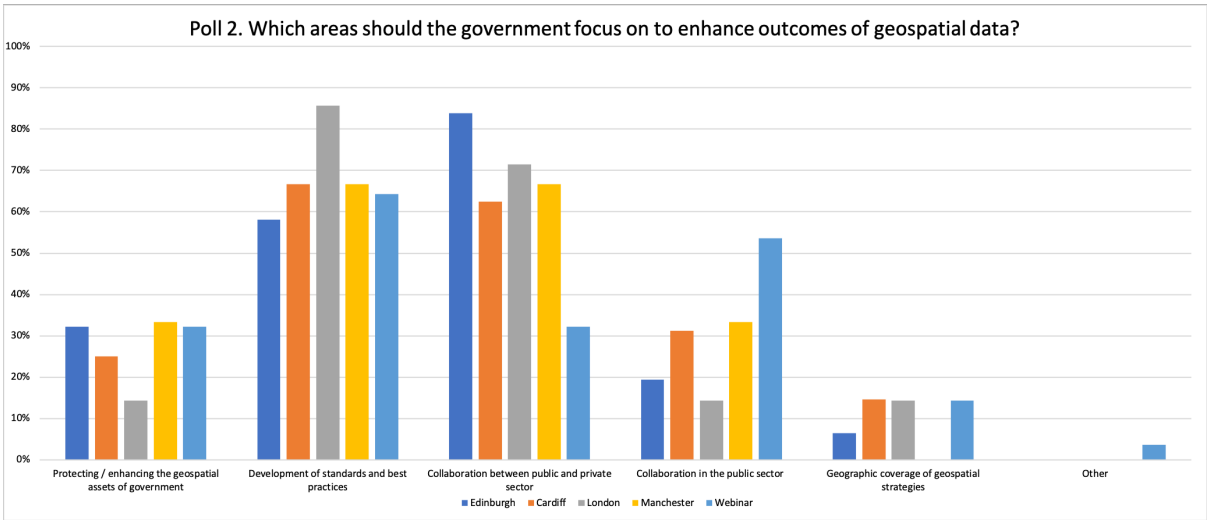
At five of these events, the AGI organised a series of informal polls, to gauge which topics would be of highest interest to the members. The topics were organised around the three themes in the Call for Evidence, with the third theme split in two. Over 100 individual representative members of our geospatial community participated in the polls.

Poll 1



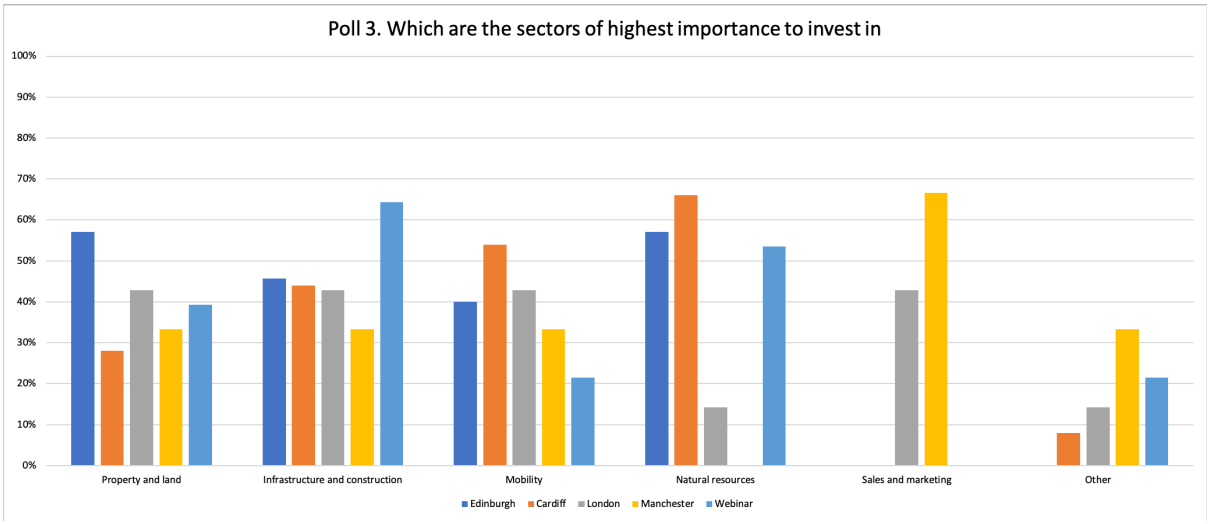
Approximately two thirds of the respondents selected SKILLS and ACCESS as the most important keywords in this poll.

Poll 2



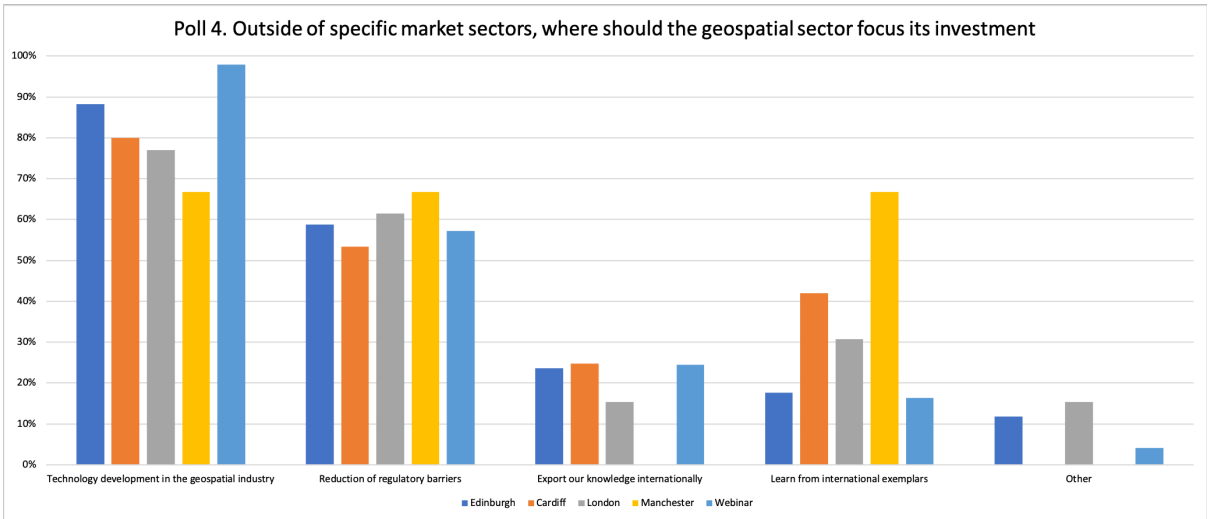
Approximately two third of the respondents selected STANDARDS and 58% selected PUBLIC/PRIVATE COLLABORATION as the most important keywords in this poll.

Poll 3



There was a relatively even spread of the first four market sectors among the respondents to this poll. “Sales & Marketing” and “Other” were significantly lower, which could be a reflection of the AGI membership.

Poll 4



Of the respondents, 85% chose “TECHNOLOGY DEVELOPMENT” and 56% “DEREGULATION”

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Association of Local Environmental Records Centres
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

There is a very inconsistent supply of land use and habitat data, which if improved would better integrate the environment into decision making - assisting with local planning, natural capital and ecosystem services amongst other disciplines.

Currently, there is no national strategy for delivering land use and habitat data to where it's needed and the data that is available is has to be sought from various sources, local and national, and its quality can't be guaranteed. But a joined up approach, linking national with local, earth observation with on the ground surveillance, would be a big step towards ensuring public sector investment hits the right areas, which will in turn help meet government commitments (such as the 25 Year Environmental Plan) as well as help business develop greener and healthier places.

The creation of the new national habitat classification system, UKHab, by a partnership of scientists and business, has created an opportunity for data to be collected, managed and dispensed in a standardised way. Public investment can now be targeted to support a national habitat data set that meets the requirements of all sectors including business, government and environmental NGOs.

In order to achieve this, public investment should be targeted by:

- Linking national organisations with local ones. Many local organisations, such as Local Environmental Records Centres hold high resolution land use and habitat data, but this is underutilised by national organisations such as government bodies.
- Gap analysis. A concerted effort needs to be made to find geographical gaps in land use and habitat data, and these gaps should be addressed by exploiting untapped sources of data and developing new sources where necessary.
- The needs of industry, particularly the construction industry, should be listened to. Industry can be a great user, and supplier, of land use and habitat data to manage natural capital and develop greener and healthier towns and cities.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

National Geospatial Commission: Atkins Geospatial View

Q1 Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

The commission needs to be careful with the wording of this questions. "Geospatial data types", to many GIS professionals, reference the standard geometry types of points, lines, polygons and raster within the GIS framework. In this question, the commission has grouped data together by proposed use and importance of spatial attribution to each dataset.

Although we agree with these broad terms, 'location' (in addition to place) is a key feature of geospatial data, as it focuses on location of places (buildings, rivers, mountains all require a location to be meaningful to us) and should be referenced.

Positional data traditionally refers to the exact position of the device collecting the geospatial data. However, in this instance it appears to be referring to attribute/descriptive information, used to provide further information and meaning to geospatial data.

Q2 In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

Engage with the Computer Science Community

The commission should engage with the computer science community to ensure that the unique challenges and opportunities provided by the wealth of geospatial data and information are more widely understood and appreciated. There is currently a capability gap in the area of geospatial software design and development that is hindering the development of novel capabilities within the UK. The capability to configure and apply COTS (commercial off the shelf) geospatial products is widely available, as are more traditional software engineering skillsets. The capability to blend these two skillsets is rare, resulting in sub-optimal solutions and reduced productivity.

Education of the Importance of Data

Much of the educational focus is on 'how' (i.e. technology and tools for capturing, analysing and interpreting data), but does little to educate on the 'why' (i.e. quality of data and the value of good data management). Tertiary, vocational and industrial educational programmes should provide that understanding of data management, how it applies to geospatial data and highlight the 'why' it matters and the benefits. This shouldn't just target GIS professionals, who generate and analyse the data, but also the whole range of upcoming professionals. It is business leaders that are going to drive up the use of geospatial data, by appreciating the efficiencies or cost-savings it would bring to business processes.

Spatial Data Chartership

Current GIS/spatial data chartership offered by organisations, such as RGS, pale in significance to RICS or RICE. These qualifications need to be overhauled and tightened so that people chartered in this area are recognised as experts, particularly in spatial data and the management of spatial data. Government should ask for spatial chartered staff working on their projects when engaging with the private sector to promote the importance of this qualification.

School Curriculum / University Courses

Schools need to ensure that Geography has a focus on data and the importance of good data in decision making.

Universities need to ensure that Geography, Ecology, Geology, Planning, Engineering etc. courses include data management and particularly spatial data management. One of the biggest problems in the engineering sector is non-geospatial staff mismanaging data. Furthermore, universities need to focus more on teaching advanced data manipulation products, such as FME. Although a solid foundation in GIS has always been provided and Python teaching progressed, a general lack in more advanced product tuitition exists. The issue can easily be resolved by orchestrating a closer (knowledge-sharing) relationship between academia and the private sector.

Q3 What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Technical Skills

In an engineering consultancy such as our own, we are rapidly automating and "digitizing" workstreams. In doing this so quickly there is a greater need for highly skilled staff who can work in the areas of data processing and data management. These skills in our organisation lie in FME and to a lesser degree python. Hiring staff who possess these skills to an advanced level is difficult and so our response is to provide a great deal of on-the-job and project training , which uncover those type of opportunities. We would like to see a more visible push for these types of skills at academic level, so that new starters to our organisation are more ready to take on the digital work.

Increasingly, we think that the dropping of the title "GIS professional" should occur, replaced with a title similar to "Spatial Data Professional", "Spatial Data Scientist" or "Digital Cartographer". We will then find it easier to promote it, when talking to school students who make decisions in their careers based on jobs they can easily associate with.

BIM

The construction industry and particularly the infrastructure sector is relatively lagging behind in its efforts to leverage the benefits of the digital world. Whilst the BIM mandate is slowly changing this poor uptake, in many respects BIM is still poorly understood at the grass-roots levels. The industry, throughout the supply chain, needs upskilling to consider more asset life as a whole and associated data appreciation. For example, designs, CAD and BIM models are not just to produce drawings for contractors - there is a need to see the downstream use of data and the benefits good spatial data provides. This includes upskilling geospatial professionals in asset management but also designers, engineers and CAD professionals in appreciating spatial data.

Many organisations within the construction supply chain are struggling to implement better digital structures due to cost implications, including the associated upskilling costs. Should this be incentivised through new commercial models that consider data quality and re-use throughout the asset and data lifecycle as part of the delivery? In the construction industry, the central government clients such as Highways England, Transport Scotland and the Welsh Government could play a major role in bringing this about.

Q4 How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

Utilities Data

During large infrastructure projects, utilities are typically a huge issue, due to poor, inaccurate, incomplete and missing digital data. Improve access to all utilities data and put in place a framework to improve the quality of this data across utility sector. For the construction, infrastructure and planning sectors this would be a major area of improvement and save millions of pounds.

Standards

Agree basic standards with all public bodies who have a responsibility to produce data. For example, a funded update/revision regime would add quality to the data in that this would now be more current. A "one-stop-shop" would ensure the saving of time and money in the acquisition of required datasets from various sources**.**

Local Authority

Remove the individual responsibility of local authorities (creating spatial data themselves) for datasets that are aggregated at regional or national level, as these local authorities often lack the funding and skills to do so. The variation in quality and format alone means it is time-consuming and a costly task bringing these types of data together for large infrastructure projects (as was experienced at HS2). For example, it is very difficult to bring all Local Authority local plan data together for these reasons andsome don't even hold the spatial data used to create the maps.

Data.gov

Data.gov is a good catalogue for existing open datasets. The search functions are good and often become the first place to look for most people. However, metadata needs to be improved for current open source datasets. Where data.gov provides access to 3rd party suppliers the currency dates are often conflicting between websites causing confusion and lack of trust in the data. The platform would benefit from a simple GIS web viewer to make it accessible to non-GIS professionals.

Q5 Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

PAF File

Make the Post Code PAF file free to use. This is a basic spatial unit and paying for access is often a discouragement for some geospatial projects. Making this data more freely available, will encourage smaller projects to consider its application and consequently ensure more informed decision-making.

Inconsistencies

Address-based products have different versions of the same address (Royal Mail, BS7666, Non-addressable) and there are inconsistences beetween addresses that Royal Mail and Local Authorities maintain. Aligning all these different address formats will save a considerable amount of money in constantly mapping one format against another.

Q6 How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

Standards

Embrace the variety of data capturing and earth observation techniques from satellite data, through aerial and UAV data capture, as opposed to ground-based techniques. Effective and efficient use of all datasets would be promoted by a set of standards to define what information could be extracted and used - from the detaile of metadata to be maintained to providing clear limitations of what can be expected of each data source.

Accuracy

Understanding accuracy and how it is applied/measured for the different techniques is absolutely key in achieving reliable and consistent products and datasets. Engaging with survey-related organisations like the Royal Institution of Chartered Surveyors (RICS) will be crucial for this.

Q7 Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Smart Cities

There are many innovative technologies available that can be used to collect, process and apply geospatial data (real-time data streaming, Machine learning and AR/VR capabilities especially). However, the focus shouldn't necessarily be on 'what' technology, but 'how' those technologies work together. With the development of the Smart City concept and data sharing becoming paramount to geospatial development, the government need to ensure that any technology it chooses to invest in will work with other relevant parts to form a fully-functioning whole. Furthermore, there needs to be consistent, repeatable processes to handle the relevant data consistently. A consistent and predictable data schema for all government-held data is paramount to the success of any new technology.

Augmented Reality

Augmented reality is connecting a world of data for people, especially individuals who may not be familiar with GIS. 3D, AR and VR are the 'next big thing' in the GIS industry. 3D models have all sorts of applications, from planning and analysis in urban development to understanding where to send first responders in the event of an emergency. When 3D modelling can be fused with virtual reality or augmented reality, it is even easier for people to understand what they are seeing. ESRI CityEngine is being used to generate 3D urban models, a key planning tool for towns and cities, which can be used in conjunction with AR and VR to make the planning process more transparent.

Open Systems = Growth

The future of GIS is rapidly changing and more connected to other disciplines and industries, such as Machine learning and data science in general. Our spatial industry is not unique, as it sits in data science and data management with a spatial attribute added to it. To increase economic growth, the ability should exist for data to be converted between systems and providers, requiring open data standards which are not bound to proprietary vendors. It will enhance future development and better use of existing data that will create value at all levels. Storing geospatial data in free-of-use databases (such as PostGIS, spatialLite, geopackage etc) makes it easy to share to any other systems and will force users to think of data as part of larger infrastructures instead of file-based storage.

Q8 How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Imagery

Imagery and laser-based datasets offer enormous amounts of information and in an ideal position in terms of utilising artificial intelligence and machine learning. Development of automated processes, using these datasets, progressed significantly over recent years, but there is still much potential for extracting more reliable information.

The same datasets are also perfect for new visualisation developments, through Virtual and Augmented Reality, and 3D modelling in support of BIM (Building Information Modelling).

Central Data Store

A centralised datastore which holds, for example, all utility datasets (like the Dutch model) would lead to better cooperation on projects and save time when a project moves from the planning stage to the on-site works stage. Furthermore, overall reduction in dataset fragmentation would be ensured.

BIM

In the Engineering sector, BIM is now the digital approach for all major infrastructure projects which incorporates spatial data. Educating the construction industry in the vital role spatial data plays in this space is critical to the effective rollout of BIM. GIS, like CAD, is the cornerstone of BIM-orientated modelling for the life of a building or infrastructure in the digital engineering environment.

Sensor Data

Create a spatial data standard for sensor data in advance of the inevitable countrywide adoption. The real power of this technology is when its viewed with other sensors and spatial data. Without a standard in place it will set the UK back decades and stunt the value of this technology.

Security

One of main benefits of GIS is that it brings together data from a variety of different places. This can also be its weakness - from a security perspective data can become more sensitive when it's viewed with other datasets. This has not been addressed by the geospatial industry and presents the potential to reject the application of spatial data in emerging technologies until addressed.

Q9 What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

More investment is required to improve standards and make data freely available to use. Create data and metadata standards and guidance, which work across all public-sector bodies and should be adhered to, to ensure that the quality of data across organisations remains consistent. Users must clearly understand what spatial data they're using, how it's been created and what it was created for. Hence, good quality metadata is critical. Users of data also need to be confident in understanding the data. If data is maintained and metadata is correctly captured, the benefits of the data will be more evident to relevant parties. Consequently, funding should easily be made available.

There should also be increased collaboration between public sector bodies - perhaps even a shared platform for users to access data between organisations and ultimately ensuring quicker decision-makingand time and money saving.

Q10 What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data? Annexes Geospatial Commission Consultation 39

<u>Unmanned Systems</u>

For driverless vehicles and autonomous UAV's to become a common reality, High Precision Global Navigation Satellite Systems and Inertial Measurement Units will need to provide continual centimetre-level accuracy to ensure the safety of occupants and the public. This will require further research into minimising satellite signal loss in cities, anti-jamming technology, and detection and avoidance systems.

<u>Smart Cities</u>

In addition to the above, Smart Cities, the Internet of Things and big data analytics will place increasingly high demands on digital infrastructure. It is imperative that the infrastructure is continuously developed and expanded to support such demands and robust, impenetrable security must be put in place.

Q11 What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector should build and deliver geospatial infrastructure to government bodies and those government bodies should own these systems. This will enable a competitive geospatial support industry for the various government bodies, ensuring that no one organisation has an uncompetitive advantage in a particular system and therefore giving Government value for money. In essence, we believe this balance already exists.

Nonetheless, the private sector, and Atkins in particular, has already learned many valuable lessons, developed innovative solutions to common problems associated with geospatial data assets, and has invested significant time and money into a proven supporting infrastructure that facilitates effective data management, efficient data dissemination and GDPR-compliant security. This knowledge and experience should be sought by the National Geospatial Commission, and private sector companies should offer their consultation services in order to guide the Commission's development and maintenance of an underpinning infrastructure and cement the UK's position as a world leader in geospatial data.

Q12 Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

<u>Missing Skills</u>

Just having standards doesn't mean that all organisations have a strategy for geospatial data and more pertinently the budget to implement them. There still appears to be poor uptake for leveraging good spatial data management at the grass-roots level. Often data is still siloed and duplicated across an organisation**.**

Challenges include:

- Unstructured, incomplete datasets: data not in a geospatial format in the first place and/or siloed within departments.
- Value could be appreciated by standardising these datasets, storing them in a centralised data environment and providing visibility to all within the organisation
- Standards should be utilised to facilitate the sharing of data between public sector organisations, such as PAS182 in the context of Smart City development.

Local Authorities

Vast diversity exists in GIS standards and requirements between and within local authorities. Even considering INSPIRE, metadata varies and is poorly understood and implemented, especially within their asset databases or local datasets. In the construction/infrastructure industry, BIM has driven change at the central government level in terms of specifying, improving and using data. However it hasn't really filtered down to local government organisations, leading to discrepancies in requirements for delivering data to multiple public bodies and thus increase effort and cost of delivery.

Q13 How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Help Local Authorities and charitable organisations standardise their data. For example, when we work on large infrastructure projects, one of biggest challenges is working with heritage data from local record centres. If the standard of this data was consistent and the local record centres followed standards, spending on heritage work on large infrastructure projects could be greatly reduced.

Q14 Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Utility Data

Utility company assets and planned works across the UK could provide valuable insight into possible complications or constraints to proposed works. However, due to serious issues concerning the quality and accessibility of such data, increased focus on the PAS 128 and 256 standards would be invaluable to ensure that useable data is created.

Sensor Data

Live data from sensors that are stored in tabular form, but easily linked to a spatial location. It would provide new opportunities to produce new datasets, in particular when it comes to environmental monitoring and traffic data. To easily access data it would be beneficial to reach the source data such as a pg dumps from PostgreSQL or similar. An API serving JSON would be a particularly productive way to access the live data instead of periodically downloaded logs for each sensor.

Q15 How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

Q16 How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

Investment

More investment in geospatial capabilities across local authorities, to ensure a position to create more formal data and metadata standards. Improved standards will ensure consistency and reliability of data across councils. Perhaps providing standard geospatial database architecture across all local authorities would be a step towards raising standards. An example is data used in the ELHEES heat mapping project, where data from local authorities has been of varying formats and quality, when it should essentially the same thing. Or in HS2 who manages contractor's data, creating the standard format in which data should be delivered. This could be developed in a local authority geospatial summit style conference to create these standards, deliver training and news across the sector. Once the quality of the data improves we should invest to make this data more freely available to use and maintain good metadata so that users clearly understand how the data has been created, what it was intended for and how it should be used.

Cultural Change

Cultural change is required as many public-sector organisations are still anxious to have their data shared amongst the community. There seems to be concerns over data quality and uncertainty regarding how entities are to utilise the data. BIM processes can in part reduce these impacts as users have assurance on the data.

Technological Change

Technological change is required. There are still many examples of data infrastructure being 'closed off' and not openly interfacing with other systems. For example, council tax and electoral roll systems often do not interface with each other. Open API should be utilised so that systems can be easily accessed. For example, a centralised system for planning applications, where data from each council is fed into the system.

Radical

Create a UK Spatial Data Centre and centralise local authority spatial data capture when it relates to data that will be aggregated to regional or national levels. This body will work with each local authority to ensure that data is captured in a consistent and standardised way and has the critical metadata in place. This will entail discipline experts working with local authority discipline experts to manage the data they collect.

Q17 As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified: • property and land • infrastructure and construction • mobility • natural resources • sales and marketing What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

Property and land

Cadastral mapping is something we see huge potential in, from a blockchain technology perspective (as part of a smart contract). If, as part of a conveyancing contract, we can get information of

cadastral boundaries, land ownership etc. onto the blockchain and instantly available, then there are surely massive cost savings available when compared to the traditional process. Blockchain hasn't gone fully geospatial yet, but it's only going to be a matter of time.

Infrastructure and construction

Within construction and infrastructure BIM has become the standard, but the skills to implement it effectively are not existing at the moment. For real value in this sector, investment needs to be made in people.

Machine Learning

Automatic asset detection from imagery. When thinking of HS2/Drainage, the use of georeferenced-driven imagery for asset extraction would be significant. For HS2 we've had to use an Atkins team to manually capture assets/defects along the road network at a large cost. This could also be used for drainage - for comparisons to as-built drawing locations of, for example, a manhole to its real-world location from driven imagery.

Mobility

Automated vehicles would seem to be the obvious way to generate efficiencies in this industry. When you think of the sheer amount of construction traffic for HS2, applying automated vehicles has the potential to save money, but also improve safety when driving through narrow country lanes.

Infrastructure

Developing an interoperable framework for sharing geospatial data for coordinating infrastructure provision is essential. Reducing disruption to roads and improving air quality requires coordinated street works activities between private and public sector - these require means to share geospatial data seamlessly. Economic value of this is discernible to all stakeholders.

Q18 Are there any other areas that we should look at as a priority?

Epidemiology, public health and medicine – such as disease cluster detection & spread, public health monitoring. Possibility exists forapplying GIS techniques on things like CT scans, x rays etc to lower the risk of misdiagnosis. Whilst not at scales usually thought of as geospatial, they are

fundamentally rasters which could benefit from analytical techniques (e.g semi supervised learning, hotspot analysis, map algebra) .

Q19 What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

Smart Roads

Some of the most exciting and world changing innovations over the next 10 to 20 years, both private and public will be in the field of road transportation. Already we are seeing a drive towards Smart Motorways, electric vehicles and autonomous vehicles. Some of the most innovative technologies already being discussed or trialled by Highways England and its consultants involve gantry free and sign free roads and motorways relying more and more upon in vehicle information systems to inform the driver, the use of autonomous vehicles on motorways and wireless charging of electric vehicles while on the move from under-road charging systems. All this technology will rely heavily on highly accurate and up-to-date geospatial data to keep roads safe and efficient to use in the future.

Drones

One rapidly developing method in which to gather geospatial data is with the use of drones and Atkins Geospatial team in the UK are at the forefront of this technology. Drone software and hardware is developing rapidly which is enabling geospatial data to be gathered quickly, safely, accurately and at relatively low cost. The main challenge for the use of drones in this field (and any other field) is that of regulations which vary greatly from country to country. In the UK this is being addressed by Nesta and Innovate UK with the Flying High programme which outlines and addresses the opportunities and challenges for implementing drone technology in 5 UK cities. Initiatives like this and changing people's concerns about drones will eventually allow them to be used more and more to gather geospatial data.

Q20 How best can we make the UK's presence in the international geospatial world more visible?

Increase the Geospatial Sectors International Profile

Increasing the UK's presence internationally can be achieved by a concerted effort to ensure we are represented at all the key conferences and keynote sessions of international conferences and trade fairs. Effective marketing of our technologies and successes, not limited to other countries' geospatial publications and conferences will build our profile.

Collaborate

Encouraging collaboration with international universities or having joined programs, especially with global leaders in GIS field such as USA, Canada, Australia would additionally enable UK to have a more global reach. Global companies with GIS departments should also be encouraged to conduct internal exchange programs and have global meetings to share ideas from all over the world and promote UK's geospatial solutions from within.

Support Developing Counties

Supporting NGOs and working in a consulting manner with developing countries to help them achieve goals through geospatial solutions would increase UK's presence in these areas as well. The industry should view these projects as a chance to raise our profile and be less profit focused.

The geospatial potential in aid-funded development programmes is small but growing in importance as geospatial teams increasingly play a part in defining required data, the collection and processing of that data, the storage, display and dissemination of that data. These are core functions which are only just being taken seriously, for example as DFID push towards a digital agenda the geospatial industry is in a prime position to partake.

Additionally, it must be noted that many countries, especially developing countries, have no centralised standards for creating, collection, storing and disseminating data. For example, bad quality data is commonplace across the African continent and more joined-up thinking is required. There is the potential for substantial consultancy work to provide the required platforms and assist in the development of standards, but it is noted this is hampered by short term aid projects acting in a disjointed manner; over-arching guidelines and capacity building to enforce these guideline is a potential future workstream.

The note that with the cost of digital technologies falling and the uptake of them increasing, how to use these technologies well to their maximum effect is increasingly important. Technology itself is not the answer to common geospatial problems such as bad data and low re-use rates, it is the understanding of how to implement that technology effectively, efficiently, and understanding of the wider context of data created, processed and disseminated, where the UK geospatial industry will be able to take a defining lead.

Q21 Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- The UK should be looking for points of comparison overseas, through international programmes such as OneGeology with more than 120 international providers.
- Land Department in Dubai, which has created a blockchain system to help secure financial transactions on real estate.
- Abu Dhabi Spatial Data Infrastructure

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Atkins
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**x**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

In my role as a Utility consultant I use Utility records on a daily basis. Collecting Utility records is a challenging task. Firstly, there is the challenge of identifying potential asset owners within the area you are working. Apart from the regional and national providers there is a litany of private asset owners e.g. communication providers which may have assets within the area. Knowing whom to contact is difficult to identify. Many private asset owners simply do not have the mechanisms to receive or to reply to enquiries of the locations of their assets or aware they may have a statutory duty to do. Of those that do supply their records there is often a charge; however this varies from provider to provider and it's unclear why charges vary so drastically. Timescale's for returns range from instant to 10 working days or more. It may take several discussions with the Utility to get the full geographical area requested thus increasing the timescales for receipt of data.

'Search Companies' have done well to alleviate the issues in retrieving this data but are limited in their ability to press the providers for better quality service and

data. Those that are PAS128 Category D compliant have provides support to the industry by adhering to best practice.

The positional quality of underground asset data within the utility industry is a legacy issue which causes issues for projects. Inadequate quality data on the position of asset data has an impact on the costs, financial risks and Health and safety risks associated with design and construction projects.

When requests are made to asset owners responses will contain different quantities of information. The provision of this information is inconsistent between owners. Such information better informs design and construction schemes.

When the position of assets are garnered through schemes and sent to asset owners my experience is that it does not result in updating of the asset owners data set.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private utility companies hold valuable asset data and will likely need support to bring this data up to a standard and form and standard that is required by industry. The private sector is likely best placed to support utilities in this process due to the size of task, its complexity, and the experience the private sector has in transforming asset-based data sets.

Should individual asset data be available in a commonly accessible way, the private sector is given the opportunity to innovatively use this data and derive value from it. If these datasets are brought under a single agency or distributed in a 'one size fits all' scenario this reduces the opportunity for private sector and locks up potential value. It's also disincentivises private companies to seek out and bring further valuable asset data to the market. By allowing the private sector (in forms such as 'trusted trader/supplier') access to existing datasets it presents the opportunity to create markets for the use of data and combinations of datasets to enhance its value.
Creating a platform or bringing these datasets under a single public body may go some way to improving access to the data and improving its quality however it will likely be at a cost to the taxpayer and provides a ridged system potentially not allowing value to be derived and potentially restricting quality improvements to the data markets may demand.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The potential for access to datasets to derive further value from them through different uses and or combinations with other data sets. As described in question 11.

Regulatory challenges are clear in the Utility industry with various legislation allowing different consumer groups different rights of access to Utility data. However, the quality threshold of this data given to all is often low. Regulation/ legislation on the quality and type and cost of obtaining data is required.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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About you and your organisation

Name	[Text redacted]
Organisation	Away Team Software Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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Academic	
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Charity or social enterprise	
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Legal representative	
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Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	Micro business & tech innovator

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Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I'm an Invited Expert at the Spatial Data on the Web Interest Group (SDW IG) at W3C/OGC leading the development Web Video Map Tracks (WebVMT): an open format to synchronise geolocation with video for the web.

Aimed at the emerging markets in 'mobile video devices', e.g. drones, dashcams, body-worn video, helmet cameras and smartphones, WebVMT allows geospatial (and other) data to be shared, indexed and presented with online media files, including YouTube. The format is an enabling framework on which to build video solutions in the geospatial sector to make data more accessible, boost economic value and support future applications of these nascent technologies. Further details can be found at the WebVMT website [7.1].

WebVMT was presented to SDW IG in early 2018 and has now progressed to 'incubation' in the W3C Strategy Funnel [7.2], with the eventual goal of publishing a full standard, i.e. W3C Recommendation.

Twelve months ago, the UK Government rejected a bid to develop WebVMT as 'standards are not strong candidates', though that policy may have since changed. Please let me know if you're now interested in supporting our work to develop new standards through innovation. More details about Away Team's wider geospatial business, including our GPS app and GPX downloads of Tim Peake's spacewalk and marathon on the ISS, can be found on our website [7.3].

[7.1] http://www.webvmt.org/
[7.2] https://github.com/w3c/strategy/issues/113
[7.3] http://www.awayteam.co.uk/

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

WebVMT was presented to the Defence & Intelligence and Emergency & Disaster Management/Law Enforcement And Public Safety Domain Working Groups at OGC Stuttgart last month [8.1], together with two use cases illustrating improved productivity, cost reduction and technology enhancement:

1. Police Evidence [8.2] describes an online system for public submission of dashcam footage as evidence of traffic offences, similar to the UK National Dashcam Safety Portal launched in July 2018 [8.3]. Adding support for WebVMT can improve location accuracy, significantly reduce police investigation time, and widen the audience to include non-dashcam users.

2. Crisis Response [8.4] outlines a mobile app which can record video with synchronised location using WebVMT and display it natively in a web browser. In a disaster zone, it enables the local population to document issues using video on their smartphones and accurately report the associated location to crisis response teams. Critical intelligence can be reliably crowdsourced from those they are trying to help and resources deployed efficiently, based on post-crisis information. A technical demo of this is available on the WebVMT website [8.5].

The Area Survey use case demonstrates how a map-track file forms a time-location key to its linked media file to rapidly index large video files by location, enabling AI solutions to efficiently search media archives and unlock data silos. Dashcam use cases can be extended to all unmanned systems, including aerial and underwater, e.g. for search and rescue, with aggregated data providing an overview of operations.

The W3C Editor's Draft for WebVMT [8.6] contains many use cases, including more details of those listed above.

[8.1] http://webvmt.org/blog
[8.2] http://w3c.github.io/sdw/proposals/geotagging/webvmt/#policeevidence
[8.3] https://www.nextbase.com/en-gb/national-dash-cam-safety-portal/
[8.4] http://w3c.github.io/sdw/proposals/geotagging/webvmt/#crisisresponse
[8.5] http://webvmt.org/demos#mobile
[8.6] http://w3c.github.io/sdw/proposals/geotagging/webvmt/

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Q18: Are there any other areas that we should look at as a priority?

Consideration should be given to a body-worn video standard for law enforcement and military use in the UK. A comparable requirement at the US DHS and IJIS was highlighted by the US Department of Defence at OGC Stuttgart, and the UK may currently be able to take advantage this through a collaborative effort.

Developing a standard for dashcam location metadata, i.e. WebVMT, would facilitate data sharing between organisations with an interest in motoring, e.g. the police, insurance industry, etc. and enable public submission of video with geolocation, saving time, cost and effort.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are significant privacy implications for sharing personal location data, and careful consideration should be given to their potential for malicious use. Individuals are ultimately responsible for their own personal security, but it would be irresponsible for authorities not to provide proper regulation and guidelines to alert the public to the possible dangers and to help them educate themselves about the necessary safeguards recommended to ensure that their privacy is protected.

Away Team includes a privacy section in the FAQ [19.1] for its geospatial products that outlines some key issues which I'm happy to discuss in more detail.

[19.1] http://www.awayteam.co.uk/support/faqs

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Government support for UK organisations, including business innovators, who wish to participate in international standards bodies, e.g. Open Geospatial Consortium (OGC), World Wide Web Consortium (W3C), etc. will help to raise and maintain the UK's profile in the geospatial world. By contributing and collaborating with our international partners, UK geospatial expertise is more likely to be valued and respected worldwide, and allow UK interests to be secured globally, with the scientific and economic benefits that naturally follow from such a world class presence and reputation.

UK presence is also strengthened by trials of new technologies, e.g. Ordnance Survey's Open Zoomstack [20.1], encouraging innovators to collaborate and develop demostrations showcasing combinations of novel concepts which reinforce the UK's leading position in the geospatial world. For example, Away Team demonstrated WebVMT at the W3C Developer Meetup [20.2] at the TPAC meeting in Lyon, integrated with cutting-edge OS Zoomstack data and Mapbox GL libraries, to synchronise geolocation with video and interactive 3d maps.

[20.1] https://www.ordnancesurvey.co.uk/business-and-government/products/os-open-zoomstack.html
[20.2] https://www.w3.org/2018/10/Meetup/

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Best practices for handling geospatial data [21.1] have been developed within the Spatial Data on the Web Interest Group - a joint committee between W3C and OGC. Significant contributions have been made by Ordnance Survey and UK Met Office, in collaboration with other leaders in the geospatial and web sectors, to create a world class exemplar which is highly valued by both by experts in the field and international bodies seeking to use geospatial data.

[21.1] https://w3c.github.io/sdw/bp/

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Basemap Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The data is a good starting point, but could go further, you have speed data that could be included as part of the commission, could also look at more detailed property information, POI data. Need to think what the end uses cases.

Public sector data is also held which can be tied by third party data licences, it would be great if this could be opened up, information on traffic regulation orders, or a geospatial version of traffic works that are upcoming etc.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

It should focus on provision of data in formats that are easy to update and utilise. Also accuracy of data, while people like the term “big data” I’d much rather have less data but more accurate information. Also ensuing there are best practices shared on how this data can be used with storyboards of potential uses to help unlock the value and stimulate ideas in non-geosppatial companies.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is limited software developers with experience of developing mapping application, the past three developers we have hired have all had to be taught the basics of GIS/Mapping and interestingly all three were originally non uk residents having been bought up in different countries.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Some data is prohibitively expensive, mobile phone data can be extremely valuable to work out where people are travelling from and to, an anonomyised version of this data could be beneficial to help better understand movement of people. The issue is the raw data is massive and hard to access.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data needs to be standardised across different departments, the inrtreoduction of the UPRN is great, however this is not used across all different departments, also as a premium dataset linked into AddressBase, this is hard to publish and use alongside other datasets. While this is new, it would be great if AddressBase data held information from the land registry directly, so you could have information all stored in one place, so the exact location of the propery from address base, the extend of the propert and land from Land Registry and MasterMap and then the address gistory from Land Registry, including all the 100 items they are looking to release into opendata.

The problem is by having all this data in different location, a remap of the fields needs to be completed whenever Land Registry/Ordnance Survey update their data, which is completed on different release cycles.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

A lot of intelligence can be gained from aerial imagery, however this needs ot be of a good scale and regulary updated. There are various different organisations that collect this data in the priate marketplace, however it is not something we have really utilised.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Data delivered by API is important for new consumers of data, however too much focus is given to this. Looking at low tech easy access datasets that non-technical people can access would be great. There seems to be move away from giving access via a download link of physical data which can then be consumed locally.

Gaining intelligence via machine learning could be good to help look at trends, though this can be prohibitively expensive for small organisations to access.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

If looking at autonomous vehicles, then geospatial data would be key in getting this to work, where is the road, what is the speed limit, what are the live traffic conditions, where are the schools etc. It can be used to build test cases and to help make any processing algorithms more efficient and effective.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Need to make their data more open and to take data creation and publishing more serious, also joined up thinking. If police/ambulance/fireservice/NHS Trust/GP and local authrotiy all have information on a resident, this needs to be potentially shared internally within the public sector to look at intelligence gained, such as domestic abuse. This requires each dataset to be maintained and published into a secure database.

For road information and highways works, there needs to be a steer from central government to ensure data like this is updated regulary and published. While the public sector holds vasts amount of great data, much of this is held in formats which cannot be easily shared. A best practie needs to be created and templates of which this data can be stored and shared.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS information is currently the best way to track and trace people, however going towards a future world of connected cars there needs to be a network that can transfer the data collected from one vehicle to another with extremely low latency – this requires a roll out of a high speed low latency network such as 5g.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector is key to getting information, sometimes it can do it much more effectively than the public sector. An example of this is we are now providing speed limit and average speed data to Ordnance Survey for their OS Highways product, this is because we have the expertise in this field, something that OS have realised and therefore is easier to resell a third party dataset than create the data themselves.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The public sector is not open to releasing of geospatial data, they have had their budgets cut and many GIS teams no longer exist. This has resulted in some local authorities paying for data twice as are unaware they have access to data.

Secondly, data when requested comes in various formats, if you ask a local authroty to provide you under an FOI the traffic orders for a region, some will supply the results as an image, others as a shapefile and others are unable to even locate the data. There is no standardisation across the public sector, different software packages are used which in turn give different results to the same question. There needs to be a template for different datasets which need to be adhered to, this means when you ask two different public sector organisations for the same piece of information, the data comes back in the same format.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It needs to understand what the data is being used for, not theoretically but in the real marketplace. At the moment lots of information seems to be theoretical, but the real creases are not ironed out until you try and use that data for a live project, then you will see the shortcoming of the data or the supply of data.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

It would be great to add speed data to the Highways data being released, both the speed limit and average speed data, this would then make it comparable to HERE/TomTom and Inrix data.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Need engagement from the public sector, need to engage not just the GIS manager, but need to engage with the highways officer, the planning officer the education officer. You need different departments to all be involved and aware in the data they hold, and what the value of their data is. The problem is best practice is only shared amongst who you know, you need this to be shared amongst all staff. Some councils have been having mapping open days, where departments are encourages to share what they are doing with mapping data with a view of sparking collaboration between teams and departments – helping to grow geo-spail internally. Once these are formed new ways of interrogating data can be produced, such as the example in Q9 with domestic abuse.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Unsure.

Q17: Are there any other areas that we should look at as a priority?

Unsure.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous vehices needs lots of legisalation, standardisation of connected car data outputs, ensuring an Audi and talk to a Ford. What is the regulation around shared this geospatial data.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

We seem to be seen as market leaders in this space, though more case studies which have value attached to them always attracts attention from overseas.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Unsure.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	British Geological Survey
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

1. The definitions are clear.
2. However, there is no mention of temporal data, increasingly we are monitoring changes in time as well as space. Real time monitoring of change, whether of temperature, pollutants or movement is critical when forecasting impacts on the environment.
3. Nor is there any mention of 'z' (depth/height); from the below ground to the atmospheric.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Economic geographers: There is a need to understand and demonstrate the value that geography can bring to projects and businesses. Quite often the benefit is societal or some form of perceived cost saving. Turning this into an economic value is critical in identifying and prioritising initiatives and securing funding (i.e. building business cases).

Earth observation: Including maximising value from space borne, airborne and ground/sea based sensors. There are two elements to this:

- Acquisition of information from raw EO, i.e pulling together vast amounts of data processing results and delivering in a way that can be used by others,leading on to:
- Onward development of outputs from this information, e.g. analysing, looking for trends, forecasting.

Data science: including:

- The gamut of spatio-temporal data statistics
- agent based modelling
- big data management
- machine learning

Knowledge partnerships, sector relation managers: It's all well and good maintaining and distributing data, but the assumption is that end users know what to do with it. This is certainly a concern for geoscience data which we all know to be critical in planning, for example, but do planners appreciate this? Are they using the right data? Are they getting enough value from it? An example initiative that addresses this is the successful NERC knowledge exchange fellowship scheme[1] that funds individuals to work across certain sectors to focus on accelerating and amplifying economic impact from its research and data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

BGS are well positioned with regards to geospatial skills needs, and are investing in the areas described in Q.2 (economic geographers, earth observation, data scientists, knowledge exchange partners). There is a particular focus on data science which we see as a rapidly evolving area in geosciences, which involves a combination of data volumes (such as that acquired through integrated networks of sensors) and data heterogeneity (geoscience covers a huge field of physics, chemistry, geography, geology, computing and economics). This complexity requires strong crossover skills including a mix of domain expertise (e.g. geophysics), programming (e.g. DevOpps) and statistics. BGS encourages scientists to develop data skills via training, and more recently are recruiting specialists to be embedded within science teams. Sharing skillsets and challenges across the wider geospatial community may encourage enhancement and retention of skills and expertise.

[1] https://nerc.ukri.org/funding/available/schemes/kefellows/

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

1. Before mentioning specific datasets that are challenging to access, it is worth noting that there is often a lack of awareness of what geospatial data exists. Even when presented with a list of datasets, some of our stakeholders are still unaware what data may be of use to them. Good metadata with outreach is an important element here. Providing amazon-style links (people who bought this also bought XX) is an example that can increase visbility of data. Webinars, sector specific communication notes and deliberate outreach activities can help.
2. Third party data held by the private sector, for example, site investigation data from the construction sector. The BGS is the national custodian for subsurface data (its records are accessed more than 100,000 times a month) but BGS only holds a fraction (c.20%) of privately owned shallow site investigation data. As previously raised by BGS there is significant value in unlocking the missing 80% of ground investigation data and making it accessible via open services. Steps to enable this could include the removal of legal and technical obstacles, educating clients and consultants as well as resourcing data conditioning and delivery.
3. High resolution terrain mapping and open bathymetry models. This data is already available but requires significant amounts of data management to get to a usable state. This must be duplicated across much of the user community. For example, BGS have recently acquired a market leading, commercial terrain model in order to develop a better assessment of ground stability for GB. However, it has taken nearly 4 months of further processing and working with the vendor to resolve previously unrecognised problems with data resolution and quality. Ideally, such issues wouldn't exist, but in reality being able to share the experience/improved data with other government bodies would remove duplicate effort and improve wider stakeholder benefits.
4. Some vector Ordnance Survey products (incl. Vector Map Local, MasterMap) are delivered in GML format. This format is a practical way of delivering data but requires a certain amount of post-delivery processing and loading by the end user so it can be integrated into their systems. As BGS frequently deal with large geographical/national areas, the burden on loading and updating the data requires significant effort which consequently impacts on how frequently we can load/update the data. Delivery of this data via web services or in proprietary format would improve access.
5. We fully appreciate certain datasets have commercial value. If we need access to this data we build a business case, and if we can demonstrate the value we will

invest in it. What is important to BGS is that the data is available, supported and maintained.

6. There are many legacy national datsets that can be difficult to source and acquire, these cover a range of themes such as geochemistry, soils, landuse, landcover and meteorology. Often the emphasis on geospatial data is focussed on currency and having the most up-to-date information available. However, accessing legacy data is an important aspect of measuring environmental impacts and change.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Nothing to add here. BGS rarely use address data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

1. The UK already has significant capability in Earth Observation data (management, processing, value-adding, downstream service provision) in a variety of sectors including research/academic and commercial. There may be some potential to address/improve coordination, but centralising capabilities may not improve efficiency or outputs. In recent years, organisations such as the Satellite Applications Catapult (and its regional Centres of Excellence) have looked to undertake disruptive marketing and to bridge the 'chasm' between research and service delivery, utilising organisations such as the British Geological Survey. The Commission could endeavour to take a fresh look at the markets and consider if there is scope to coordinate initiatives. One potential gap in the UK is a consistent structured forum to gather people together regularly to discuss the UK's capability, the market areas, and what can be done. There are some meetings (e.g. UK Space Agency Earth Observation Advisory Committee) but none that includes all sectors.
2. While there is scope to improve coordination we do not believe that centralising capabilities would improve efficiency or outputs. There are already a number of earth observation centres of excellence that operate effectively and deliver a high level of outputs.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

1. Exitsing technologies that require continued investment:
    a. Invest in InSAR to identify changes in the earth surface such as subtle ground movements. From this it would be possible to generate a range of products and services including site-specific average annual ground motion velocities, interferograms and coherence maps up to national scale. Potential downstream users of this very detailed positional data include development of accurate 5G models, navigation for autonomous vehicles and defence.
    b. Continue to invest in geodetic and magnetic observatories. Understanding how changes in the earth's forces affects positional accuracy is again necessary for users that rely on highly accurate positional models (e.g. 5G, autonomous vehicles, defence)
2. New technologies:
    a. There are already several groups addressing 'big data' and many are looking at AI and machine learning. We suspect that AI and machine learning have scope to help us derive significant new information and services from big data (incl. EO). These technologies should also improve efficiency in production and delivery of results. This is an area that requires focus.
    b. Companies such as Airbus and SSTL manufacture satellites, but the UK does not have its own satellites, apart from NovaSAR (in development). It may be worth considering whether there is any scope for the UK to have a national presence in orbit with satellites in a post-brexit world. BGS would be happy to contriubute to this.
    c. Blockchain and crypto-location technology can provide a more secure and efficient alternative to location data systems in use today. This should benefit anything that relies on streaming geographical data such as sensored instruments, smart cars and smart cities.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

1. EO data and applications are fundamental here e.g. application of EO data such as InSAR to routinely monitor energy production sites to ensure they are operating within an agreed tolerance and therefore may be permitted to operate
2. Energy, including the siting, location and monitoring of renewables such as wind, geothermal, solar, pump storage and nuclear and other resources (especially in optimising coupled systems e.g. wind + pump storage, or minimising sterilisation of existing natural resources e.g. offshore seabed aggregates)
3. Smart infrastructure (e.g. dynamic loading or buried cables): investing in smart networks, i.e. knowing where things are and where the environment impacts on them

(e.g. improved models for mitigating corrosion, subsidence, heave, erosion, river scour, flooding, tree fall and contamination). Taking a systems of systems approach to managing assets and extending design life and mitigating degradation.

4. Agrimetrics and precision farming. Developing very high resolution models from national terrain, weather, geology and land cover datasets to create a better understanding of environmental conditions to improve yield, performance, and sustainable use of the environment. Use of autonomous vehicles (typically drones) with advanced sensors and imaging capabilities enabling farmers' new ways to increase yields and reduce crop damage.
5. Autonomous vehicles. Autonomous cars and drones all rely on highly accurate positional models and a constant stream of data to enable them to move around accurate and safely.
6. Internet of Things. Including sensors embedded in everyday things communicating information about the environment around them. Explore ways of transmitting 'location' and other data packets in a secure and efficient way.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

BGS relies on accurate data so that it can deliver authoritative, high impact research and applied scientific solutions. It is critical that public sector organisations are able to invest in maintaining and enhancing their geospatial data assets. For BGS, we do this in the following ways:

1. BGS is responsible for maintaining the core geological data/models of Great Britain. We do this through a mixed combination of National Capability funding from Government and income generated through commericial licensing. We also have mixed delivery route where the core geological data are available to view at no cost (through a variety of online map viewers and WMS), but access to the underlying data is charged via a commerical licensing process. This mixed funding and delivery approach enables us to support open and commercial access in a sustainable way.
2. BGS develops a number of commercial data solutions. These include subsidence models to the insurance sector, electrical resistivity models of the ground to power companies, and 3d models of ground permeability to the Environment Agency. These commercial data solutions are developed using in-house scientific expertise and with support from specific market sectors where there is a clear demand.

We also recognise that with a nationally joined up approach to third party data acquisition and inclusion, those national dataset assets affected by new (contributed) data could be maintained and updated in a more coordinated and timely manner. There are questions as to how can we validate/trust the results from contributed data but it is a potentially powerful and sustainable way of maintaining and enhancing data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

This is an area of importance and is something BGS is heavily invested in. We maintain a number of geospatial infrastructure networks and frameworks. These are described more fully in Appendix A, and include:

1. The British Isles continuous GNSS (Global Navigation Satellite Systems) Facility (BIGF) run from the University of Nottingham.
2. The Space Geodesy Facility: the UK's unique geodetic observatory, operating Satellite Laser Ranging, GNSS and Absolute Gravity instruments.
3. Operating a number of magnetic observatories and stations across GB.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Looking at this question in two parts.

1. The role of the private sector in underpinning infrastructure

We see this as a realistic ambition. The UK has some leading IT tech companies which deliver highly performing data infrastructure. We should take advantage of this. However, there is a need to ensure accountability with measures in place to adequately protect the data.

2. Enhancing the UK's geospatial data assets

This presents a bigger challenge for the private sector with questions as to whether data capture and maintenance could be universally applied at a national scale, with a consistent level of quality. This is where the national mapping agencies, with their in-house domain experts, excel. That said, and as previously noted in Q.9, we recognise the potential that bringing in 3rd party data contributions can make in enhancing UK's geospatial data assets if done in a coordinated way.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There are a number of challenges when accessing data across the public sector, including:

1. Discoverability. The first step is finding the right data. Data.gov.uk is a starting point but has become overwhelmed with metadata, and finding the data you need among thousands of other datasets can be a challenge. The latest version of data.gov.uk has become less user friendly than the previous version particularly with reference to spatial data views and discoverability. We appreciate that data.gov.uk is only as good as the information entered into it, but it has been inflated with poorly attributed and updated metadata. The publishing organisations need to be more accountable. The INSPIRE portal[2] is an alternative example which may be worth evaluating.
2. Access. Assuming you find data, accessing it is the next barrier. Data is supplied in a variety of formats, all with different levels of attribution and details. Standardised formats and dictionaries help knit data together. There are already a number geospatial data standards that exist which are being actively maintained. Two examples:
    a. The OGC international standard organisation, develops and supports standards and their implementation. It acts globally through its membership of international organisations, but has locally based forums which can examine issues more relevant to its membership.
    b. The long developed and implemented UK and AGI metadata standard, GEMINI, has recently been updated to the latest INSPIRE advice incorporating UK BSi/IST36 thinking for geospatial metadata. It is based on ISO/OGC 19115 global geospatial standards.

These are both successful initiatives and we would encourage the Geospatial Commission to work in collaboration with these standards.

3. Licensing. We recognise that licensing across the public sector is necessary to protect intellectual property and generate income. However it could be simplified. The introduction of the Open Government Licence (OGL) was a step change in public sector licensing. A simple, consistent licence, written in plain language has made the process of incorporating public sector data in our research and downstream data products far more efficient. We fully support the broader notion of a consistent public sector licensing framework to encompass open, innovation and commercial licensing.
4. Support. Data must come with some support and documentation to help the user understand how to use it appropriately (e.g. scale, currency). Without this information the data is useless. When the Environment Agency pushed large numbers of data out as ‘open’ as part of the Open Defra initiative BGS struggled to access the appropriate support for the data, which resulted in us accessing alternative products. The fact that the data was open and therefore delivered at no cost was no consolation.

[2] http://inspire-geoportal.ec.europa.eu/

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Like BEIS before them, the Geospatial Commission should continue to provide opportunities for the end users of data to feed in to the process of acquiring, evaluating and using geospatial data that have been purchased on their behalf. BGS have been active in the PSMA community and have had representatives on PSMA User Representative Group. We feel we have had ample opportunity to get involved and provide feedback to budget holders and decision makers within government.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

1. Planning data from local government. Accessing planning information to optimise how we use our available space, and ensuring that best use is made of the resources available. e.g. ensuring we are not sterilising, damaging or under using any element of the Natural Capital available.
2. Buried infrastructure and utilities. Knowing where these are assists the identification of vulnerable assets (from ground movement, flooding, etc.) and planning maintenance.
3. DaaS and web services, rather than downloadable data that we all need to manage individually. Data delivered under the current public sector data licences could be delivered as a centrally managed web feature service rather than each individual user loading and updating data into their systems every few months.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

BGS continues to work closely with all devolved administrations (NI, Wales and Scotland). From our experience we feel that:

1. A new Geospatial Strategy should recognise that expertise already exists in the devolved administrations and they have many shared ambitions. It should therefore act as an enabler in bringing similar services together and not build competing or replacement services.
2. The Geospatial Commission are in a unique position to provide an oversight of strategies across governments, raising awareness of these to the geospatial community, coordinate activities and relevant work programmes.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

BGS have worked with local governments across Britain, and have observed varieties of approaches taken by different authorities. Increasingly we are seeing consortia of Local Government units working together which is delivering consistency and efficiencies both for Local Government and BGS (in terms of procurement and supply of services).

One of our NERC knowledge exchange research fellows recently conducted a review of use of environmental data in the preparation and delivery of Local Development Plans in Scotland[3]. The review concluded:

1. Local planners are apprehensive of using the wrong data or using the right data in the wrong way. They are concerned around the risk of making wrong decision for which they will be liable and risk upsetting the local community.
2. There is a need for training, user guidance, more support (workshops, secondments, webinars) in the appropriate us of the data
3. They require a centralised data service that contains authoritative and current data. Versioning and the burden of data management is a problem in the current system.
4. Planners do not always want tools to help them make decisions. They want supported, robust data so that they can make apply their own judgement to make their own decisions.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

[3] **BGS. 2018**. Current environmental information used to inform Local Development Plan preparation and delivery, External Briefing Report, British Geological Survey, OR/18/040, pp 12. [Submitted as a separate paper with this response]

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

1. Property and land

We already distribute geoscience data via data resellers that operate in the property and land sector. This works very well for us as they reach out to much wider audience than we can reach, develop solutions and products where there is customer demand, and deliver data in smarter, cost effective channels. They are far more efficient that we can be.

2. Infrastructure and construction

Sharing site investigation data (as previously noted in Q.4)

The development of 3D and 4D solutions to this sector to deliver cost savings and de-risk projects which could be scaled up city wide. An example includes the development of a BGS 3D geological model for Farringdon Station, as part of the Cross Rail project, that assisted in the design of the tunnels and de-risked the construction project[4].

Geoscience and geospatial advice and services are frequently requested by National Grid, Network Rail, Highways England, Distribution Network Operators and many water companies to enable them to manage, construct and develop better infrastructure. Many projects have wider applications for other stakeholders in similar roles/sectors.

3. Natural resources. Identifying natural resources and monitoring/managing environmental impacts of their extraction. Two specific examples:
    a. Develop a water resource model; where, quantity, quality and vulnerability to pollutants.
    b. Energy: identify, measure and monitor a range of energy technologies such as ground source heat/cooling potential. Develop ‘smart grids’ capability.

Q18: Are there any other areas that we should look at as a priority?

[4] https://learninglegacy.crossrail.co.uk/documents/3d-geological-model-completed-farringdon-underground-railway-station/

1. Britain has a 200 year legacy of industrialisation. Some of the more difficult aspects of that legacy concern contamination (land, air, water). Geospatial analysis for optimising brownfield reuse, landfill resources, legacy mine resources and future waste management and containment should be considered.
2. Global hazard impacts. International contributions to a range of hazards that have a significant impact on large global populations. Examples: volcanic ash, space weather, coastal flooding, marine slides and tsunamis, droughts, harvest failure.
3. Smarter understanding of ecosystems services in the UK. Investing in better geospatial models of the services our landscape provides such as water resource, landscape amenity, preservation of heritage, preservation of unique environs such as peatland, chalk downs, coastal plains, identification of links between blue and green infrastructure and the underpinning landscape (and geology) that enables it. Identification of novel resources for future generations (e.g. Rare Earth Elements) as well as traditional aggregates for home and infrastructure building.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

1. Building Information Modelling (BIM): the process of creating and managing digital information about a built asset. Ensuring data is robust, interoperable and delivered in a way that can be maintained for the life-cycle of the asset.
2. The development of a National Digital Twin and the work of the Digital Framework Task Group Centre run by Digital Built Britain.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK can justifiably already be identified as a world leader through Government geospatial agencies. Leading in Europe in the development of INSPIRE standards for example.

Elsewhere British agencies are already being sought as a partner of choice in the delivery of World Bank projects, e.g. BGS in Nigeria.

As leaders in the OneGeology[5] global geoscience data initiative for over 10 years, BGS have developed and implemented geoscience geospatial data with 119 countries worldwide. It has done this through the development of technical standards, tools, and support which has significantly improved the interoperability of geological data. The associated OneGeology-Europe project for INSPIRE succeeded in developing a harmonised data model (based on existing international standards) for 1:1 million geological map data, and is serving these data for 21 countries through OGC-compliant

[5] http://www.onegeology.org/

web services in a multilingual portal in 18 languages. The project also succeeded in developing a single license for use of these data.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- Singapore: LIDAR mapping of the whole country and indoor LIDAR of all public spaces, linked to detailed 3D geological modelling of planned transport network. BGS has been advising Singapore for a number of years and they may leap frog us in terms for going from 2D to 3D surface and subsurface data.
- France: Large scale BIM project (Paris Metro)
- Netherlands: Subsurface Key Register (BRO) for the sharing and linking of geospatial and other Government transactional data (Ministry of Infrastructure and Environment and TNO)[6]. Aim is to improve accessibility of subsurface information.
- Australia: Digital Earth Australia (DEA), automating ingestion of EO data and Positioning for the Future (using GPS, Glonast, Indian system, Japanese, Galileo, China positioning satellite network plus ground stations). (Geoscience Australia)[7]. The project has links with the UK Satellite Applications Catapult.
- United States: Earth Cube - developing cyberinfrastructure to improve access, sharing, visualization, and analysis of all forms of geosciences data and related resources[8]. EarthCube is a collaboration between the Division of Advanced Cyberinfrastructure (ACI) and the Geosciences Directorate (GEO) of the US National Science Foundation (NSF).

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[6] https://www.tno.nl/media/3064/010591_r71engelstalige-factsheet-dec-20112.pdf
[7] http://www.ga.gov.au/dea/home.
[8] https://www.earthcube.org/

Appendix A: BGS capability in underpinning geospatial infrastructure

1. BGS is responsible for the British Isles continuous GNSS (Global Navigation Satellite Systems) Facility (BIGF) run from the University of Nottingham. BIGF is a unique and secure repository of archived GNSS data (GPS and GLONASS), with holdings dating back to 1997. The data held at BIGF are from a network of 160 continuously recording stations, sited throughout the British Isles. The archive comprises 1,730 station-years of 30-second data, and 617 station-years of 1Hz data. The data are provided to BIGF free-of-charge by a number of collaborators, including the three national Ordnance Surveys of Great Britain (OS), Ireland (OSi) and Northern Ireland (OSNI). BIGF contributes to the European Permanent Network (EPN), the International GNSS Service (IGS) global network, and the IGS Tide Gauge Monitoring (TIGA) Project. BIGF provides the only long term archive of data (and associated metadata) for all continuously recording GNSS stations sited throughout the British Isles, including the BGS run Space Geodesy Facility (SGF), at Herstmonceux.
2. The Space Geodesy Facility (SGF), at Herstmonceux, is the UK's unique geodetic observatory and operates Satellite Laser Ranging, GNSS and Absolute Gravity instruments.
    a. Satellite Laser Ranging (SLR) is SGF's primary observational purpose. BGS staff carry out analyses and research using data from other SLR stations in the international network that directly impact on the determination of the International Terrestrial Reference Frame (ITRF) and knowledge of its accuracy. The societal need for an international reference frame (the ITRF) has been acknowledged by the United Nations, through the resolution 'A global geodetic reference frame for sustainable development' adopted in 2015 and further strengthened in 2016 by the establishment of a UN Permanent Sub-Committee for Geodesy. The ITRF is an essential part of 'scientific infrastructure' that is effectively invisible to those who benefit directly or indirectly from it. All users of positional data for disaster monitoring, surveying, satellite navigation in vehicles on the ground, in the air and in orbit, and many more applications, depend upon the operations of a small number of globally-distributed geodetic observatories whose multi-technique observations create a consistent reference frame.
    b. Two GNSS receivers are installed at the SGF. Both receivers have accurate site-tie vectors to the satellite laser ranging system at SGF, adding to their value both in the determination of, and in linking all UK GNSS receivers into, a multi-technique global terrestrial geodetic reference frame (TRF). GNSS data from SGF are supplied to the BIGF.
    c. The SGF has developed an Absolute Gravity laboratory and the technical skills to operate the instruments. The measurements at SGF are made as part of good practice at a geodetic observatory and to study local ground movement, such as that driven by tidal loading, independently of the results from satellite tracking, and for research into environmental effects on gravity

measurements. Yearly-average values of the local value of acceleration due to gravity (g) are made available to the international scientific community.

3. The BGS Geomagnetism Team deals with geomagnetic observations, data and models, and operates a number of magnetic observatories and stations across GB. BGS is responsible for producing and maintaining a number of geomagnetic products including:
    a. a model of the geomagnetic field for Great Britain, which is used by the Ordnance Survey to provide magnetic north information on its mapping products. The model is updated annually.
    b. the BGS Global Geomagnetic Model (BGGM) is produced for the oil industry and is revised annually.
    c. playing an active role in the production of the International Geomagnetic Reference Field (IGRF) published by the International Association of Geomagnetism and Aeronomy (IAGA). The IGRF is revised around every five years.
    d. a number of near-real-time products relating to space weather effects which may temporarily degrade the accuracy of the models listed above.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Bluesky International Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**x**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes it is accurate from our perspective.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We believe there could be more support for ‘on the job’ practical training, e.g. apprenticeships. There are some, but in the Midlands for example, it is only Coventry University that seems to offer any sort of formal collaboration.

The Commission should use its influence to penetrate tertiary education and create an environment in which the importance of geospatial data and the industry as a whole is given a far wider platform.

In early education there could be easier access to mapping, aerial photography and other datasets so there is a familiarity with geospatial data from an early age. The Commission should apply pressure for additions to the curriculum.

Careers advisors/centres need increased information and knowledge regarding geospatial jobs and opportunities, a geography teacher isn’t the only option if you study geography related disciplines.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

At present there is a lack of properly qualified photogrammetrists and GIS specialists in the UK, however this isn’t the only issue. Even if this pool of suitable candidates were to exist, the cost of exclusively appointing UK based candidates would be prohibitive due to the current expected win pricing from tendered contracts.

We would consider offering apprenticeships, if a proper framework and structure existed.

One particular area that seems to be lacking is machine learning specialists. This is an area with huge growth potential and the labour market is immature and poorly served at present.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The advancements towards open MasterMap promises much and would be a huge help to Bluesky. Open building footprints would help us to unlock vast amounts of value from our own data using machine learning.

Better free traffic flow data would be useful to us for noise and also Air Quality modelling.

Addressing will also be a key consideration. At present there still seems to be a number of challenging issues and Ordnance Survey, GeoPlace and Royal Mail need to be aligned better to facilitate an open, accurate address standard for the UK.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Addressing and address location should be free, coordinated and accessible. As new technology emerges, especially automation in transport, driverless vehicles etc location will be key and will rely on a trusted national standard, and custodian to ensure consistency and reliability.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

At present there is an understandable excitement around UAVs and satellites, however most of the EO data used in the UK is certainly from manned fixed wing aircraft. Neglecting aerial survey is dangerous, and it unquestionably needs support in order to continue to underpin the UK's core geospatial infrastrcture. This could come in the form of influcencing Air Traffic Control to making access into challenging airspaces easier, especially for government contracts.

UAVs are starting to play a peripheral role, but they will not, in the near future replace manned aircraft. The Commission should be wary about being led down this path, as the UAV market is still immature and there are still a number of huge barriers for unmanned aircraft both globally and particularly in the UK. Some of these include significant flight restrictions, limited payloads, unproven accuracy of final data.

We believe that there is a vast range of increased applications in data derived (using AI) from EO data, and aerial survey will play a major role in that, unlocking billions. As the frequency of capture and resolution increases, along with the recent specification improvements such as true-ortho, the value of this data to the wider geospatial industry is multiplied.

The recent shift toward a more mature 3D geospatial landscape is also very encouraging. 3D will become the new standard and geospatial products captured from fixed wing manned aircraft will be at the heart of this. The world is in 3D and our data should be too.

Satellites also offer an exciting and tempting alternative, however they also currently have a range of limitations that would still introduce inconsistencies in national data provision. They have great potential in other areas eg. more accurate positioning, or hyperspectral, non-optical datasets.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Cost effective cloud computing would increase processing efficiencies and enable the most effective exploitation of huge geospatial datasets. Perhaps investigation into a government sponsored cloud computing system that contractors could use to process huge volumes of data. This could also support computation modelling and machine learning.
Also combined instrument and sensor payloads, increasing the efficiency of flying airborne sorties. LiDAR, oblique aerial photography and vertical aerial photography (and possibly more) could be acquired in the same flight.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data will play a key part in the successful rollout of 5/6G. In an industry that has been heavily dictated to by software, it now needs to fundamentally change its focus to data providing the catalyst for the software vendors to improve their platforms.

Geospatial data is unquestionably the most valuable component in the emerging autonomous vehicle landscape. Airborne and groundbased LiDAR and optical imagery should be combined to provide virtual landscapes and cityscapes that are continuously updated in realtime by the vehicles themselves.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Make more Government owned data assets open. Coordinate and mine other prolific government data creators (Met Office, Environment Agency, Centre for Ecology and Hydrology, Forestry Commission, Historic England, English Nature etc) Whilst much of this data is free it is not particularly accessible and usable.

Encourage public/private partnerships, for bigger data acquisition projects serving the industry as a whole.

Let longer term contracts to allow private organisations to invest fully in technology and deliver more value over time.

Derived datasets being created by the public sector from both public and privately owned datasets could be made available and accessible if the funding was in place to facilitiate the appropriate licensing for this.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

A standardised, accurate and open network of ground control points would be a definite benefit to the wider geospatial industry.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should have a major role, but it must be coordinated and managed by government. We need to ensure that data is created to the same standards and specifications, to allow full interoperability. Government needs to lead this and private sector must meet those requirements and work with government to ensure the data gets maximum use. There should only be one source for each data type.

Also the data needs to meet minimum requirements which is not always achieved for the price that the 'customer' is willing to pay. The track record of organisations producing geospatial data for UK use needs to be a consideration.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Ordnance Survey licencing is still a challenge despite much recent improvement.

The overall data quality from some open data sources (Eg EA LiDAR) varies a lot and can cause issues if relied on. Some of the data available via the EU (eg Landuse) is of low resolution and would be much more use if it were higher specification eg for mobile network planning.

Use of Land Registry data is still very confusing due to the inherent Ordnance Survey IP. The access and cost of efficiently using Land Registry data is still a huge frustration to public and private sector organisations.

Licencing would sort some issues out, technology could sort others, but often we just need to spend more on the data at the development stage to ensure we can get best value out of it.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Ensure fair and even licencing and make sure all geospatial data is to a set standard, perhaps even an ISO type accreditation. Ensure there is only one source of a particular data type being used across government. Encourage the use of web services, which will ensure all bodies are using the same data and it is updated regularly and efficiently.

There are examples of the public sector undertaking tasks that are already being successfully undertaken in the private sector. There is a requirement to facilitate effective agreements between the public and private sector generate asignificantfor the tax payer

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Datasets from the Met office, Traffic data, soils, Valuation data, ONS datasets.

Datasets such as building type, age, use, roof slope, roof type, building material, number of floors etc

Creative licensing initiatives could facilitate more cost effective and efficient usage of these datasets. Pay per click models or call off charges could replace the need for expensive initial investment.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Introduce sharing frameworks but make them mandatory. We recognise more investment will be needed in local authorities for this to be effective. If the investment is made now there will be significant savings in the future.

Uniform national datasets e.g. APGB represents a great exemplar as authorities, central government and emergency services are all using the same data. Any derived datasets will be based on the same data and can therefore be easily shared.

There are already some great examples of local authorities exploiting imagery and height for various applications. These case studies need to be extracted and shared. Maybe create an independent team that can move around the authorities, in particular the less advanced ones, spreading the word, training and sharing examples and best practice.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Making sure there is an aerial survey (eg Lidar) for all construction sites and all development.

Investment in detailed and accurate city models including street mapping.

For property the move to 3D must be accelerated and more widely adopted.

Sales and marketing would benefit from open address data.

Accurate and detailed utility risk mapping based on rapid airborne LiDAR and imagery acquisition across large geographical areas.

The Telcos industry must start to use accurate and more granular terrain datasets for network planning. At present the majority of the industry uses low resolution and poorly maintained clutter data.

Q18: Are there any other areas that we should look at as a priority?

The private sector national aerial survey data is being produced to the same specifications as Ordnance Survey aerial survey data therefore duplicating effort and cost. Ordnance Survey should licence the private sector data to allow them to fulfil their remit without restriction or royalty payment. Ordnance Survey could then concentrate on their core remit of producing world leading national mapping products.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Smart cities
Autonamous vehicles
5G/6G
Accurate insurance premium calculations

As with all developing technologies there will not just be one organisation that comes to the fore with solutions. There will be a wide range of approaches, opinions and innovations that need to be coordinated and rationalised before being consumed by both the geospatial industry and beyond.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Encourage more Public and private sector partnering on overseas geospatial projects. Bluesky has been involved in an excellent project with Ordnance Survey and another private sector partner to Map Malta recently.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	BP
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
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Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The 'adopted' BP definition of Geospatial Data is:
Geospatial Data (or geographic information). Data or information that implicitly or explicitly identifies the geographic location of features and boundaries on, below or above the surface of the Earth. Such data is usually stored as coordinates and topology. It is 'data that can be mapped'.

The Commission's use of the word "place" is very general: even more so than the term "location" from a spatial perspective. Our worry is that this could potentially be viewed as "watering down" aspects of Geospatial.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Skills:
Geospatial ‘critical’ skills – analytical analysis, spatial awareness, problem solving, automation, data science.

Possible paths to ensure capability:
Work to implement a Geospatial component in High School Geography classes.
Alignment of ‘traditional’ higher education courses (geodesy, geography, survey)
Open access ‘Citizen’ map and app building.
UK Open Data portal.
Online courses for accessing data, building maps and applications.
IoT technologies integration
UK layers within Google maps to expose them to the wider public

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Needs and Gaps:
We have a very strong technical Geospatial community. We would need more expertise in emerging trends such as automation, big data, AI, machine learning, remote sensing and data science. Also, marketing expertise; the ability to ‘sell’ geospatial within the organisation.

Promotion:
Promotional events at schools and universities – these could be co-organised with interested organizations who could present ‘what we do’.
An advertising campaign: maps or interactive dashboards in public places to stimulate interest.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

High quality marine and bathymetry datasets of UK waters. This data could be crowd sourced and served – basically the EMODnet initiative but higher resolution and UK-centric.
Civil Hydrography Programme Data.
Higher resolution landuse data as a service.
We would be very interested in an open source road network dataset for the UK to support logistics. This would invole sharing the Integrated Road Network (ITN) perhaps?

A government data portal/catalogue could be set up to streamline access.
Improved data with open access would be of immense value as it would cut down. on the time organizations spend on ETL tasks, increase user confidence in the

data and decrease the need for duplication and storage.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Addressing is an important factor in how we run the geocoding for our logistics and retail analysis. Inconsistent addressing can often disrupt this work. As location data and analysis becomes more ingrained across disciplines addressing would likely play a key role in spatializing non-traditional data so a standard address system would greatly help in this respect.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

First maximise the usefulness of existing data, a portal and cloud hosted data products available as image services would be beneficial. ESA Sentinel hub requires effort and cost to access as a service in addition to little access to historical imagery.

See the work done with ESRI's Living Atlas and Sentinel-2 Explorer App: https://communityhub.esriuk.com/geoxchange/2018/6/4/sentinel-2-now-in-the-arcgis-living-atlas

We currently have our own version of this with extra band combinations and focused on BP areas of interest. This is served via AWS cloud infrastructure and we've captured tiles going back to launch date.

Having input into a dedicated UK satellite network or the ability to disseminate and distribute its outputs.

Near IR high-resolution imagery at a frequent revisit is not there yet, this would

revolutionise environmental monitoring (e.g. methane reduction) capability if available.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Artificial intelligence and machine learning integration.
Big data technology
Automation
Mobile
Network Infrastructure
Geospatial Industrial Internet of Things (IIoT)
Elastic computing scalability
Flexible data modelling
4D time aware capabilities
Autonomous vehicles and vessels
5G – public services, smart cities etc

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

5G is a good example here – 5G signals are very sensitive and will require a denser network to function efficiently. Geospatial data and apps could be a key tool to design these denser networks.

Autonomous vessels.

Smart port

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Collaboration between organisations: working groups to break down the 'silos', agreement and adoption of standards to improve synergy.
Invest in smart devices and network infrastructure to meet the rapid increase and demand for digitised data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

IIoT data and 5G networks will need several positioning requirements to support them as they have very short ranges.
Consideration of the impact of the removal of GNSS and GPS access to UK business, is there a GPS redundancy plan?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Share our internal data publically where applicable – our BP Response portal is an example where we are already doing this:
http://bpresponse.maps.arcgis.com

The private sector could join working groups, provide guidance and knowledge.

The Commission could create incentives to participate for the private sector.
The ESA Sentinel programme has shown that the private sector can develop tools and services off the back of public data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We are a private company however we do ingest a number of public sector datasets. We would like to see simplified and standardised methods for how this data is delivered – ideally cloud service based with the ability to ingest it for advanced analysis.

Using the flooding example maybe there could be a dedicated extreme weather response body much like the Emergency Management Institute (FEMA) in the US to ensure that collaboration is consistent and a routine activity.

A simplified process to find and access appropriate data: A catalogue or map could be established which public agencies would be able to contribute to.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Providing an outreach and marketing function.
Audits and surveys to assess levels of demand and to determine what the public wants.
Effective medium for the private sector to liaise with the commission and other relevant public bodies.
Sharing data in the easiest way possible.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

UK AIS Data – to assist simultaneous operations.
UKHO datasets
Land use
Road network
Extreme weather tracking

Access provided as cloud based services.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Outreach, marketing, public sector conferences, workshops, boards for relevant data types (US model) etc.
Embed Geospatial Commission resources within regional and local bodies. This could be for a set time period until the desired strategy becomes more defined and 'business as usual'. Or have local and regional resources 'tied' to the Commission's remit is some part-time capacity.
Assign nominated 'domain tags' from pool of SME's to promote best practice, chair workshops etc.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Probably already tied to the mobility and natural resources themes (but not listed in the strategy document):

Maximising (non-mobility) service networks – how can people easily determine where the closest service facilities are (healthcare, emergency, civil defence).

Fisheries monitoring: which boats are entering UK waters, for how long, how large are they, estimated catch size etc.

Q17: Are there any other areas that we should look at as a priority?

Collaboration between public bodies. A clear road map of where is body is right now and where they want to get to.
Provide a clear picture of what data is available now.
Quick adoption and change management as this is a rapidly evolving sector.
Ocean and marine mapping: huge opportunity for the UK to be a global player in this space as <15% has been survey in any meaningful way.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Drones
Autonomous vehicles
Autonomous vessels

These technologies face a number of regulatory challenges as regulation of their use does not exist yet (in any great capacity).

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Publications, marketing, great data presented in a great medium.
Captivating applications that deal with real world issues.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

ESRI living atlas
EMODnet
IoT key players such as Apple, Google, ESRI, TIBCO etc
Emergency Management Institute (FEMA)
European Space Agency
UK - OGA
US - BOEM

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Bradford Metropolitan District Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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Individual	
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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No our view of the geo-spatial data types is not accurate. Need to nominate the definitive organization for particular datasets with data extraction, transforming and loading already in place and the right update method.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Satellite Imagery, Radars and aerial photography.
Mapping features on the surface of the earth that are incessantly changing.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Geo-spatial skill relating to open data. FME Server courses examples will help utilize Open data In the most effective way.
Efficient ways of searching data on the internet with time reduction in the search and data integrity and authentication.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Challenging access datasets are those found in a fragmented way. Too much work is spent on gathering them like time spent to integrate them into a standardized workable way, and automated mechanisms to directly update them without affecting the applications they are being consumed by.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes, emerging technologies need to find ways to facilitate the simultaneous display of different data types and the amalgamating of these datasets so when queried should yield new datasets with new valuable information.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

These capabilities (Earth Observation data) should only be concerned with the addressing of global issues such as climate changes or extreme wheather conditions.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Radar technology
Rainfall (Rate Of precipitation) data
Lidar technology
Cassi data (C.E.R.N arial photography)
Satellite imagery for change analysis

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The enabling of the above technologies to be compatible and integrated. Applications could use them to derive totally new sets of data revealing information never obtained before.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Via funding new software using these geo-spatial data sets and linking them to the business sector.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Care home provision
Remote health Care intervention.
Tackiling crime
Tsunami rapid Detection
Emergency Services rapid deployment

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Driving the sector using innovation development and enhancement usage. Providing relevant information on the spot.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Minimizing the search with optimized results for the open data. Officializing the definitive data custodians, those who provide best comprehensive solutions. Usage of Interoperability systems such as FME Servers and FME for Desktop are already addressing some of the pressing issues such as automated feeds or updates.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Acts as a watchdog and steering into the right directions.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Seismological data and meteorite monitoring

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

By adopting a number of acceptable strategies that should be inclusive for everyone. Also reinforcing standards from the base level and feeding in to the highest national custodians.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Offering interoperability of systems capability to all Local Authorities.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Flood preventions
Flash Flood prevention
Man made Disaster Management
Natural Disaster Management

Q18: Are there any other areas that we should look at as a priority?

Natural Resources Preservations
Water Quality

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Rainfall Detection for flood risk Prevention
Emergency Services

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Promote Latest innovations by applying them when helping countries afflicted by large scale disaster.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Europe (Germany)
Asia (China)
Best practice was the INSPIRE project (Infrastrucure for the spatial Information in Europe).
Indication of getting the foundation right first.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	British Property Federation & UK PropTech Association
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	

Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

While the first three geospatial data types make sense, it would be helpful in public-facing documentation to include example data for each type to make sure that the definitions are commonly understood. For example, building footprints are an example of geospatial data; price-paid data from HM Land Registry are an example of positional data; a building identifier present in both the building footprint data and the price-paid data is an example of a geospatial identifier anchoring the price-paid data to the building footprints.

In terms of specifics relating to positional data, unlocking the full potential array of uses of geospatial data requires some work to enable the identification of individual buildings (and it is hoped premises). Part of the challenge here concerns how a building has been defined by data holders for their own purposes. Now that pooling datasets using shared identifiers is becoming the norm, this is

surfacing that problem. For example, the VOA may identify hereditaments that a) do not always represent a building given that they relate to chargeable units for Business Rates purposes, and may not necessarily reflect a neat structural slice of a building, since excess space may be sublet or assigned. Similarly, an EPC may not relate to a whole building but merely a part of the building designed to be used separately, and even then that may depend on its energy arrangements. An identifier for buildings could be game changing in allowing various datasets to be attributed to buildings, given that this has been challenging in the past.

At the level of Geospatial services, it may be helpful to disaggregate this level. Our understanding is that there may be products and services that are provided by data holders themselves. These might include the provision of data drops in epochs or via APIs, for example. In some cases these might grant simple analysis of the data held by the data holder, or the ability to query data in a set way. The TFL API is a good example of this, offering various means to query Santander Bike data, next bus times.

However, to extend the TFL API analogy, downstream developers of products and services can take the raw JSON data offered via the API and parse it and repackage it, pool it with different datasets and create new products and services. All of these activities would be subject to licence constraints.

Further analysis is needed as to the incentives, penalties, constraints and operating choices of participants in each of these sub-tiers of Geospatial Services. Most importantly, while the data holders will be influenced by the user needs of the clientele of their direct customers, developers of products and services using their data, this will be indirect unless the data holders invite some form of user feedback.

There are two further dimensions of data that we are keen are embedded at the level of positional data in particular: time and elevation.

Given the changing nature of the built environment and land, an ability to track performance/change over time will be beneficial, whether that concerns land values, changing hereditaments, data relating to planning and building regulations approvals. This will have implications for how data is released, kept and maintained.

For the future of land and property services, an ability to understand the position of buildings in 3 dimensions will be critical for delivery of the future anticipated benefits of last mile delivery via drone, view corridors, City Information Models and other benefits. We understand that the Commission will be operating a 5 + 5 model for its Strategy, and therefore we consider that the infrastructure it is seeking to deliver in terms of data capture and provision needs to reflect the technologies likely to manifest over the next decade.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In the real estate sector, there is greater need for promotion of the benefits of the use of geospatial data. The BPF last year partnered with the Royal Geographical Society on a survey of BPF members regarding their approaches toward the use of geospatial data and received only a very limited response. Wider adoption is necessary for the delivery of aspirations such as a digital twin for UK land and property as a whole, and to the extent that construction clients (developers and owners of real estate) are asking for the benefits of GIS and geospatial data to inform their decisions. Partly, this is a role for the provider of such services to perform, but there perhaps needs to be the embedding of greater awareness and understanding of the benefits of GIS and geospatial data techniques in property management, planning, urban development and other built environment related courses that are targeted toward non-GIS and geospatial specialists (to the extent that those entering the workplace know the purpose and uses of GIS and geospatial data and are able to effectively procure it).

Similarly, despite Government targets relating to Building Information Modelling, adoption of higher levels of BIM remain a rarity in our sector. This is something the BPF is seeking to tackle via a toolkit for BIM 'advocates' within commercial and residential development companies designed to demonstrate the benefits of the use of BIM models to disciplines such as sustainability management, asset management and facilities management, in addition to commonly cited benefits such as reducing construction waste and nugatory efforts (e.g. through redoing of works due to scheduling errors). We imagine that BIM modelling could feed in beneficial information into wider land and property data.

Further, general data literacy within the real estate sector requires improvement. This will involve both Government and real estate sector employers working with the universities and the Institute for Apprenticeships to ensure that secondary and tertiary education involves embedding of data literacy in formal qualifications.

The importance of harnessing existing built environment professionals is that there are existing sources of regulated professions that could be of assistance in providing data as part of their duties. Currently, such fine grade data disappears meaning that resources such as the OS Mastermap are not updated with new information and future projects will have to measure the same space once again. From this flows also the conclusion that it is not just the 3D coordinates of location information that need to evolve.

Finally, there is profound interest among members, partly spurred by the Social Value Act and partly by the imperatives of science-based targets, to understand the economic, social and natural capital benefits and disbenefits that development may bring. We therefore need a responsive structure of recording and publishing land-use, zoning, local plan designations, protected spaces and buildings and the soft effects of emotional responses to the environment.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Please see our response to Question 2. Further, the BPF and a number of other sector bodies, local government bodies have submitted a proposal for a real estate sector deal that could be used as a catalyst for geospatial skills. We are awaiting a verdict from central government on the proposal.

The technology industry benefits from data provided by Government and arms-length bodies. The attainment and preservation of the UK's lead in geospatial data is predicated upon adequate geospatial skills at all levels of Government. The Government may wish to consider whether it wishes to make geography/geospatial a career pathway and service within Government. It may also wish to vest in an Officer the accountability for the profession in Government, and for the quality of the data that is published for use by private sector organisations. This would not only help to promote the profession, but also to ensure quality outcomes.

In terms of skills gaps, it has become clear that users of geospatial data are not only drawn from geography disciplines. A number of companies in the BPF and UKPA memberships are applying machine learning and data science techniques to geospatial data. Further, those that are so doing may be applying knowledge to a data problem with backgrounds in mathematics, computer science, physics, social science and other fields. A number of members are showing promising results from the application of such techniques to geospatial data in areas such as improving the customer journey in residential conveyancing or in understanding building performance. Therefore, derivation of the maximum benefit of geospatial data may not solely depend on encouraging more young people to study geography with geospatial data techniques, or indeed geographers to retrain, since addressing many challenges in the built environment will require multi-disciplinary teams. However, this kind of purposeful, varied work is likely to pose a draw in itself to those seeking to work in the geospatial data space.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Utilities connections

The regulatory arrangements in the sector for electricity, water and gas connections, and how these interact with new development continues to be problematic. The regulated industry must work within the constraints governing their sectors and how these are interpreted by the regulatory authorities, Ofgem, Ofwat and Ofcom. Sometimes these regulations and their interpretation limit the extent to which companies operating in the sector can choose to invest with unintended consequences.

The mention in the call for evidence document of the need to understand where utility infrastructure lies resonates with us, given that the lack of visibility can often lead to delays and additional costs to development. In fact our members highlight it as among the top causes for delays (and therefore costs) to timely delivery of developments.

This repository of utilities infrastructure has been a Government target for some years, and it is understandable that this problem has not proven tractable given the plethora of statutory responders who can currently charge for access to their records.

Identification of Land for Development

A key contributor to delivery of housing targets and bringing agglomeration benefits from development to local communities and cities, the identification of land for development should be a priority from Commission data release. This may need to be supplemented by Government data. It is likely that machine learning can be of assistance in parsing and making inference from datasets, as has been undertaken in a number of other domain spaces (e.g. shipping).

OS Mastermap

The release of the OS Mastermap is to be welcomed. The call for evidence document is right to alight upon issues relating to updating any national data model for land and property. To some extent this can be informed by data collected by professions (see our response to Question 2) but there is a need to be cautious about digitising the past, particularly in the long term). Therefore, the Government should perhaps be thinking in terms of issuing a mission-based challenge under the Industrial Strategy, deploying Government's convening power to identify ways to maintain a national 'digital twin' for land and property.

Lessons can also be learned from overseas. While the UK currently has a competitor advantage in terms of the data and form it has at its disposal (e.g. the OS Mastermap), other countries that are seeking to develop something similar are evolving different methods toward tackling the problem.

Land Registry

The Land Registry has been assiduous in releasing information in iterative format for the release of data that enables agile companies to trial and innovate products and services based on that data. A key challenge to unlocking the maximum value from that data has been the arrival of concerns relating to a perception that fraud or national security risk might manifest if full details of property is made available. Risk assessment in this space needs to be on the basis of credible risk rather than risk aversion.

Asset management

There is significant activity among market leaders in real estate ownership, investment and development in obtaining better data in relation to the performance of assets. This is being driven by fundamental changes in the nature of what customers want from their buildings, whether that is greater flexibility around occupation or from healthier buildings to occupy. This in turn is leading to greater interest in the adoption of techniques such as building information modelling, and the curation of analytics across the building lifecycle. It should be recognised, however, that many companies are grappling with data hygiene challenges, particularly around older buildings and/or those buildings that have been acquired without a historic record of fundamentals relating to building performance. Moreover, the vast majority of UK buildings are without the necessary sensor technology that permits tracking of day-to-day operational use. Finally, real estate owners need to know the level of granularity of data required to manage a building well - this is not always immediately transparent, given that it will often depend upon the extent of provision by the owner of services to the tenant (e.g. energy, telecoms and connectivity).

Finally, there are a number of standard operating procedures that have been created without data exchange and transparency (either between owners and occupiers or between owners around acquisition and disposal of buildings) that need to be negotiated. This underlines the need for iteration and user research to be key techniques to be deployed in seeking to obtain better data and analytics around land and property. Again, it would be helpful to coalesce industry efforts around an obtainable goal. There is significant industry interest around the concept of Building Passports, containing within them pertinent data relating to building performance, in an interoperable format that can accompany the property throughout its lifecycle. If the Commission and the sector were to craft a shared vision of what this might look like, and how private sector and public sector sources could interact, this might help to catalyse progress.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The identification of real estate assets can vary across the ecosystem of data that is pertinent to properties. For example, in Valuation Office Agency data, buildings are split into hereditaments whereas in examining the Central Register of Energy Performance Certificates, a certificate may relate to a whole building or an individual demise.

This situation renders challenging the ability to map data relating to a building to 'premises', if we understand premises to be the unit of a building that can make more sense to its owner, occupier and someone seeking to add value to either both or one's needs.

Resolution of this issue may not be immediately tractable, but it is mentioned here to flag that the potential for transformation of land and property data and a national model are faced with legacy challenges. Overcoming them will require an iterative approach, and a consistent dialogue with the sector. Underscoring the need for user research.

Certainly, in opening up more datasets, it would be beneficial to increase the use of common geospatial identifiers across different data holders to allow different datasets to be joined around common fields referencing a building or premises.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The call for evidence document is right to alight upon issues relating to updating any national data model for land and property. To some extent this can be informed by data collected by professions (see our response to Question 2) but there is a need to be cautious about digitising the past, particularly in the long term). Therefore, the Government should perhaps be thinking in terms of issuing a mission-based challenge under the Industrial Strategy, deploying Government's convening power to identify ways to maintain a national 'digital twin' for land and property.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

For the UK real estate sector, some of the most promising offerings that utilise geospatial data derive from PlanTech combining internet of things, digital innovation, data and user-centred design to tackling planning challenges. This is as much so because of the enhanced visibility it offers to both micro and macro challenges, but also because it can offer a means to offer insights in a climate of constrained resources within local authorities.

Further, the places we live are becoming more complex and entangled, meaning that resource problems and outcomes from the planning process are likely to become more challenged in the future.

Plantech also illuminates a particular problem; given that it will concern artificial intelligence, internet of things, data analysis and machine learning to parse natural language in planning applications, we urge a note of caution in the Commission seeking to pick winners. The Commission will need to be cogniscent of wider initiatives across Government that are seeking to promote technology adoption and create complementary initiatives that fill gaps that stand in the way of the development and maintenance of national geospatial data. It may be that a mapping exercise can be undertaken based on responses to the Call for Evidence to analyse where these gaps lie and act accordingly. To do so would also ensure that the Commission can remain focused and provide a clear, evidence-based rationale for its actions.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Please see our responses to Questions 2, 4, 14 and 18.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Vision and Strategy

For public sector organisations to continue to invest, we think it will be important for the Commission to set in place a vision for the outcomes that the Commission is seeking to achieve and the outputs that are necessary to achieve it. By outcomes, we are suggesting the goods and benefits to be achieved and by outputs we are referring to the means by which these can be delivered.

By envisioning outcomes, both private and public sectors can hopefully be aligned toward a set of shared goals (even if some individual goals still remain, which is a realistic expectation). By enumerating outputs (and hopefully in setting a series of dates by which these might be achieved) the public sector can give the private sector some investment certainty, and both parties are kept on-track to deliver the outcomes envisioned in the strategy.

For the built environment, it is important to consider what an end game might look like. This can be challenging given the plethora of industry and Government initiatives that are seeking to gain better resolution as to how cities, buildings and premises perform across an array of categories from health and wellbeing, to environmental performance to title and geographic information.

In the view of our members, it is critical for the Government to focus on establishing a geographic identifier for buildings that can be consistent across datasets. At present, the defining characteristics of a building can vary across public datasets, and the way that the private sector can resolve this is via the provision of geographic identifiers.

Further, interest in new forms of ownership of property will depend on being able to clearly identify buildings and their ownership. This will require retooling of existing registers, but as we have said elsewhere in this response, there is a need to tread carefully. Preservation of the core function of the Land Registry is necessary, but the suggestion in the call for evidence for appeal to the Regulatory Pioneer Fund for the purposes of trialling and innovating new series and models by Land Registry (and other data holders) in shadow form is a way to address this. Indeed this is no different a concept than the Land Registry's transferral from the storage of paper deeds to its current model.

Finally, the collection of geospatial data for future proofing truly needs to be in four dimensions: 2D coordinates accompanied by additional height information and the ability to search through time series. Understanding the history of a site is important for the purposes of land appraisal and due diligence as well as remediation. Understanding what lies above and around a building in three dimensions has implications for rights to light, future delivery methods including drones and driverless vehicles. It also grants enabling infrastructure for city information models, albeit these would need to be accompanied by wider BIM adoption.

There also needs to be a read across to other work the Government is undertaking. For the built environment to take full advantage of geospatial data to unlock better places for people, there needs to be a supportive governance framework for big data, internet of things, cybersecurity, real time monitoring of sensors and this to be reflected in an array of standards for data exchange, building construction and maintenance. This is no small task, but we think it vital to be considering how the UK can avoid simply being a fast follower of other countries that are adopting new methodologies to gather the information that the UK already has, while also embedding the infrastructure to deliver on the outcomes we enumerate above with perhaps greater agility.

Enabling Steps

The Geospatial Commission's proposal to support a number of enabling data projects is beneficial from the perspective of creating a strong foundation for future work as acknowledged in the Call for Evidence. However, the manner in which these enabling projects are conducted may capture or omit a further benefit to be obtained from lessons learned in the conduct of each program. This may need to include insights from where things have not gone well, unexpected outcomes and how the conduct of such programs could be improved in the future so as to improve outcomes.

Such conduct involves radical candour and openness, as well as iteration and consultation with users and customers. Lessons can be learned from the conduct of the opening up of the OS Mastermap for how such projects can be conducted.

The other issue to bear in mind is that there must be sufficient incentive for holders of public sector data to release it. Provision of that incentive may derive from public service and transparency, in which case they may be able to provide the internal resourcing necessary to support its release. Alternatively, the data release may support a revenue stream, in which case the release of data supported by some commercial interest may lead to some revenue being reinvested in data enhancement and upkeep. Alternatively, the organisation itself may benefit from the release of data, either through the accrual of fungible resources or through influence or delivery on objectives (e.g. the Environment Agency releases flooding data which acts as a disincentive for development on flood plains). In this last case, the organisation may be willing to devote resource to the upkeep of the data in order to continue to deliver on those objectives.

If the primary motivator is financial for the release of data by public authorities, high licencing fees for data access may prove a barrier to entry for startups seeking build products and services from the data. Such organisations may wish to consider whether they are able to offer free-of-charge access to such companies, which is a method commonly deployed by cloud services providers as a loss leader. One way to avoid loopholes could be to time limit access to such free-of-charge arrangements and require sign up by company number.

Some of our members have also suggested that it would be beneficial to create a register of sensor infrastructure across the UK. Much of this information is already captured by the VOA but may not be disaggregated so as to readily provide this information, yet the role of such infrastructure is often noted and therefore may be a relatively simple parsing exercise. Members articulating the need for this register suggest that having this register might elicit the release of new products, services and partnerships between organisations (e.g. by leasing infrastructure) and second would avoid some of the historic issues surrounding the lack of visibility of location of existing buried infrastructure such as pipework being repeated in newer internet of things/sensor infrastructure.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We do not feel best placed to answer this question.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector companies are let contracts in a number of areas to maintain registers and repositories of data that are pertinent. We do not see that changing in the future because they require expertise and knowledge that may not be held internally.

What is critical is that contracts embed forms of incomplete contracting that permits some flexibility to changing technological requirements and opportunities. Further, there is need to avoid unintended consequences - the legacy of data protection concerns as framed in the early 2000s fed into the framing of the contracts for the Central Register of EPCs, which in turn led to constraints in granting access to the data. While access to the data has been delivered incrementally, investment was not made at the outset to foster a structure that permitted it. In other words, contracts with private sector organisations need to reflect the Commission's longer term goals, and need to be struck with organisations that understand this context.

Further, there is a need to ensure that in releasing geospatial information, sight is not lost of the important core purposes that some data registers and repositories perform. The Land Registry, for example, is a critical third party verifier for security of title which in turn is critical in its functioning for preserving the UK as a venue for inward investment in real estate.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

In general, the challenges related to the use of Government data relate to the fact that currently datasets are scattered and siloed, partly by virtue of the institutional structures that have given rise to them. Functionally, this means that data needs to be queried from a variety of sources, and practices in delivery of the data to users vary, but many cannot currently be retrieved via an API (which would be preferable). Where data is provided via an API, often the licencing limits or rate throttling are such that they add unnecessary limits, and are often accompanied by a lack of detailed documentation and a lack of robust data standards.

Data, particularly where not served via an API, is often rendered in a format that is not readily usable, such as as a .xls or .pdf, whereas it is preferable to receive it in a machine readable and/or streamable format such as a .pkl or JSON file.

Further, web systems are often provided with inappropriate security policies and validation, both leaving them open to attack (e.g. SQL injection) in the former case and leading to the untidy data in the latter case.

Currently, data is often provided at a macro scale with a relative degree of accuracy, but data at finer scales on a geographic or temporal basis are often unavailable. One can aggregate geospatial data to local authority scale or over a broad timescale but data at daily or hourly rate is not available. This is partly owing to the fact that some datasets are refreshed infrequently or not at all, and some do not go to that level of resolution.

As is often the case with any data source, there are cases of improperly coded or formatted, or accompanied by null values and missing data.

Our respective memberships have given more granular feedback on the use of certain datasets. We would be happy to host a roundtable with representatives from the data holders and the Commission to talk through concerns and feedback as to what is working and what is not, if helpful.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission will need to ensure that in renegotiating contracts for data management and curation, as these come up for renewal, it is able to embed the objectives of the Commission in revised contracts as necessary.

It will also be vital for the Commission to engage in user research with arms of Government that are most likely to use the products and services that emerge from the Commission's work. In the case of land and property, this might include the Government Property Agency. This will help to ensure that the Commission facilitates products and services that users will want to use.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

In terms of features that would make the data useful to our members and to the emerging tech companies interested in applying data-driven techniques to real estate, a number are lacking:

- There is currently no single UPRN scheme for property across datasets
- Of UPRN schemes that are used for properties, it is not used consistently
- There is no agreed definition of a building or premises, meaning that these are understood differently in the data dictionaries of different datasets, so linking must be achieved by address matching which is difficult and error prone since addresses are not properly encoded or formatted
- There is a lack of complete geographic reference and lookup tables which are essential for understanding which local authority a postcode district belongs to, assigning a name to a postcode district and converting between geographic hierarchies)
- There are currently no free geometries (e.g. GeoJSON points for postcode districts)
- There is currently no free publicly available address database with as primary key every property unit in the country (including historical properties) with coordinates. Preferably this would be established as the official register. While the UK has legacy systems (e.g. Land Registry) it is critical to understand that mapping exercises is how many fast followers and leading competitors in GIS and geospatial information are tackling this problem differently and achieving faster results

We are able to offer more granular comments on individual datasets and would recommend that a workshop be convened with our members to allow more detailed feedback to be given. We have sought in our response to give high level feedback in keeping with the Commission's broadly strategic role.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

In speaking to members, the feedback has been that for land and property there are not currently significant differences in operating across devolved administrations.

Although there are different property registers in Scotland and Northern Ireland, for example, they operate in a similar way to the Land Registry. As such, the Government's approach toward having a shared central spine of goals for geospatial strategy across the UK, but permitting some deviation of means, is the most appropriate. This could be supported by coordinating mechanisms for the development of shared standards to underpin policy goals, where appropriate.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

We suggest that a bid is made to the Sector Challenge Fund, to which we may be able to contribute as BPF and UKPA, to endow Local Partnerships to engage in a series of pilot workshops to understand pressures on local authorities and suggest remedies. The outputs from these workshops could be channelled into a set of toolkits that local authorities can deploy in seeking to release data.

Local Partnerships is a JV by HM Treasury and Local Government which brings together leading edge experts solely for the benefit of the public sector and the delivery of public services and infrastructure, and so are very well placed to deliver such an approach.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would

particularly welcome responses from industry and other bodies engaged in these sectors.)

We would urge the Government to consider the report the BPF commissioned from the Future Cities Catapult that details how the UK real estate sector can improve and preserve its productivity through the adoption of technology. Geospatial technology is featured. The report is available here: https://futurecities.catapult.org.uk/resource/lost-in-translation-how-can-real-estate-make-the-most-of-the-proptech-revolution/

We also have forthcoming a report on how the UK can preserve and enhance its positioning as a crucible for PropTech. This report will be out in Spring 2019 but we would be happy to brief further on its findings toward the end of the year once initial findings are complete.

As related in our other question responses, the Commission's 5 + 5 years strategy needs to take into account anticipated technological development in the built environment over that timeframe. It also needs to look beyond residential use cases and toward the commercial built environment, given the need for quality business premises across the economy.

Q18: Are there any other areas that we should look at as a priority?

We agree with the general priorities but missing from the account within the Call for Evidence are:

- Use of enhanced planning insights for masterplanning development, including understanding transport need, infrastructure need and housing need
- Mapping energy efficiency potential of housing types in order to pave the way for the street-by-street approach that is needed
- Assembly of a state of the nation of the built environment, to improve policies that concern building standards or regulation concerning buildings
- Analysis of cities by layering onto detailed GIS models data from other sources to obtain insights. For example, the work that Sidewalk Labs has undertaken with US cities using Waze data to replan and retool transport networks
- Better city transport models to make available to citizens
- Enhanced due diligence models around acquisition of buildings using data sourced from a number of different layers. There are companies present in this space already who are able to create new modules to provide for customers
- City works planning to avoid duplication of effort and poor scheduling of street works
- Ways to share and/or gain enhanced insights from data across the private and public sector domains without breaching data protection rules
- Other phases in the building lifecycle in general where currently data driven approaches toward real estate and land are under represented include construction, demolition and remediation and acquisition

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We enumerate the main challenges and reasons below:

- Planning - much information taken into the planning system is given as natural language which is more challenging to analyse and turn into categorical or continuous data
- Commercial and Residential Property norms - the patterns of control, use and ownership of data in buildings, particularly where leased, are not straightforward and there are some sensitivities around data release among commercial tenants. This can also mean that ownership data is difficult to obtain (which stands in the way of tokenisation of property, for example)
- Cybersecurity and fraud - the release of some data could afford the opportunity for phishing and spoofing by third parties, but data release is necessary for the innovations this call for evidence is pursuant to
- Asset management – understanding from sensor data better the outcomes that buildings deliver, and as interest in triple-bottom-line reporting and tracking proliferates, understanding of non-financial operational data
- Privacy – there is currently a somewhat uneven playing field between regulated

private companies, unregulated private companies and companies that are incorporated in the UK vs overseas in their curation and use of data relating to private individuals. Sensor data gathered as a matter of course as 'digital breadcrumbs' from social media, mobile phone sensor data, wifi scans and so forth build up a picture of group mobility patterns from which can be inferred other features such as social class, home and work location data and so forth. This is particularly the case when teamed with other data sources which may not derive from public sources (e.g. Uber Movement, TFL data). The locus classicus of the unintended consequences of teaming datasets can be found in work around the Netflix Prize dataset by Cornell researchers who were able to make inferences about individuals through teaming with the IMDB dataset. This perhaps underscores the need for exploration of what data can be collected at all levels regarding physical persons and how that data can be subsequently used and commercialised. This is not intended to create undue restrictions, but merely to urge a degree of responsibility and ethical behaviour in data holders and their clientele.

- Data Ownership – as data gains greater intrinsic value, the Commission may wish to consider the implications of data collection and use in the context of rights and ownership.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

DIT is already a partner of both the BPF and UKPA in trade missions and conferences overseas and at home, including MIPIM, Expo Real, Future PropTech. These audiences would be a suitable venue for showcasing UK expertise to foreign governments and markets. The BPF and UKPA would be delighted to explore how a partnership could be struck with the Commission for trade promotion overseas.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Clear exemplars are offered by the Singapore Government and the US Federal Geographic Data Committee. Countries not in the vanguard on geospatial data also benefit from a roadmap recently launched by the UN and World Bank to help them make use of geospatial data as they address development challenges.

It is also worth examining the methodologies of Open Street Map in international development projects, wherein agile methods are deployed in order to deliver enhanced and updated geospatial data in a short space of time.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

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23 October 2018

Written evidence submitted by the British Standards Institution to the Cabinet Office on the National Geospatial Strategy call for evidence

BSI welcomes the establishment of the Geospatial Commission and can support the objectives of the Commission and the National Geospatial Strategy in a number of ways:

- **Core technical standards for geospatial data -** Geospatial and positional data relies implicitly on the underlying standards used to define their structure, content and encoding; without this, exchange of geospatial data between suppliers and customers would not be possible. BSI technical committee IST/36 manages UK representation to ISO TC/211 that defines the core global technical specifications for geospatial data.

- **Technical standards for the application domains of geospatial data -** The application domains for geospatial data are extensive, but the standards governing data definitions in these areas are fragmented and sometimes do not reference core components defined by ISO TC/211. Many of these data definitions are managed outside of the formal standards process. New and emerging areas such as Smart Cities, Building Information Modelling (BIM) and Connected and Autonomous Vehicles have brought this to the fore. BSI would like to work with the Geospatial Commission to better coordinate and standardize data definitions across distinct market verticals.

- **Standards for market functioning** - Although the focus on standards is often at the technical level, standards can be used to help stimulate and grow the geospatial data market. Currently we have identified that users procuring a geospatial data service are confused how to do so and have no reference point to determine if the service will satisfy their business objectives. In the converse, suppliers of geospatial services have no mechanism to objectively verify to customers that their service is fit for purpose, sustainable, ethical and operated legally. A recognised standard could be a major market stimulus and enabler. It could also help facilitate a richer landscape of trusted public and private data suppliers through capturing and agreeing current good practice.

- **UK international positioning** - Through our standardization activities, BSI has positioned the UK as a major international leader in topics such as BIM and Smart Cities. BSI lead on the standards development at a UK level and fed this into the international standardization process. These topics have a major geospatial data component. Accordingly we could look to build on this to more widely promote geospatial data, or look to determine how geospatial data can be more 'front and central' across all application areas.

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About BSI and Standards

1. BSI (the British Standards Institution) is making this submission as the National Standards Body for the United Kingdom. BSI has a public function in support of the UK economy. We bring together stakeholders (including government, industry and consumers) and facilitate the development of "what good looks like".
2. Voluntary standards offer a flexible, adaptive and collaborative alternative to regulation by providing common languages, terminologies, guidelines and good practice developed by and for stakeholders. As the UK's National Standards Body, BSI operates in accordance with an MOU with the UK government. Our robust standards development process requires open and full consultation with stakeholders to build consensus based outcomes. This gives standards the legitimacy and degree of market acceptance to be used for public policy purposes.
3. BSI is independent of any one stakeholder interest; our standards development process requires the involvement of all relevant stakeholders along with an open public consultation process. This provides the credibility for standards to be used as an alternative to regulation, to support regulation or to demonstrate compliance with regulation.
4. While regulation may be required to correct a market failure or to address an urgent consumer protection issue, standards offer a market led opportunity that may provide better and more flexible solutions. BSI's standards offer the opportunity to achieve government's policy objectives and provide the flexibility not afforded by the regulatory process.

BSI and Geospatial Data Standards

5. BSI is actively engaged in standardization activities where geospatial and positional data are a core component. This includes emerging and establishes practices such as Smart Cities, IoT, BIM, Digital Twins, Connected and Autonomous Vehicles and Smart Assets. This standards-centric view, often at international level, across all these activities provides a global, holistic overview of the geospatial market.
6. BSI manages IST/36, the UK committee that provides input to ISO TC211 - the international committee responsible for the core geospatial standards.
7. BSI has had a long standing engagement with the EC INSPIRE Directive. The EC INSPIRE Directive[1] specifies legal requirements for how Member States should publish, structure and deliver their public geospatial data. The directive is due for full implementation in Member States by the end of 2021[2]. BSI has been involved with drafting the INSPIRE data specifications and continue to work with the EC and the Defra INSPIRE Team with update and revision of the standards.
8. BSI has been working closely with Centre for Digital Built Britain (CDBB), a partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge to deliver a smart digital economy for infrastructure and construction for the future and transform the UK construction industry's approach to the way we plan, build, maintain and use our social and economic infrastructure[3]. CDBB's vision is a digital built environment that will enable improved outcomes for society.

[1] https://inspire.ec.europa.eu/
[2] https://inspire.ec.europa.eu/inspire-roadmap/61
[3] https://www.cdbb.cam.ac.uk/

9. In response to the National Infrastructure Commission's report Data for Public Good, CDBB have established the Digital Framework Task Group (DFTG), who will establish a "data framework" for the built environment that will enable a "national digital twin". BSI sits on the DFTG, and has working relationships with bodies such as OGC and Building Smart. Geospatial data is considered a key component of this data framework, along with BIM, FM/AM, Smart Cities and IoT.

Question 1) Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

10. The distinction between geospatial data and positional data, where the location aspects are an attribute of the main object in question, is a valid approach. However, it is not clear if the term 'position' applies only to the spatial location of an object or if the temporal location is also included. This is important as spatial location is time dependant, for example the location of a moving vehicle on a road.
11. It is not clear what is meant by geospatial identifier. We assume it is meant to refer to a proxy for a coordinate system such as a postcode or named geographic region; for example 'the car is on the A4155' or 'the house is in W4 4AL'. If so, we are happy with that distinction, but positional data can be 'anchored' to geographic data through a coordinate reference system.
12. The term 'geospatial services' as defined is confusing. 'Geospatial services' is commonly used to refer to an application (typically a web service) that can deliver geospatial information to users. For example WMS, WMTS, WCS and WFS. WMTS is the geospatial service that delivers tiled map services such as Google Maps. 'Geospatial Products' is probably a more widely understood term.

Question 2) In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

No comment

Question 3) What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

No comment

Question 4) How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

No comment

Question 5) Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

13. BSI committee IST/36 is responsible *for BS7666:2006 Spatial datasets for geographical referencing*. All British Standards are subject to active management and BS7666 is currently proposed for revision. Any changes to addressing and address data should be reflected in revisions to BS7666. This will ensure trusted agreement and wide adoption of any new

approaches. All changes to British Standards are subject to open consultation including engagement with consumer organisations where appropriate.

Question 6) How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

14. Earth Observation data chiefly comprises imagery, altimetry and positioning data. All of this data relies on geospatial data standards to ensure its accuracy and consistency. Earth Observation data is often categorised according to the level of processing applied to it[4]. The market for EO data is generally interested in data processed to Level 2 and above as this is the level where the data can be most readily utilized in different application areas.

15. Earth observation data can be processed to generate data products for a wide range of markets; there are however limited public standards defining Level 2 (and above) data processing and associated data products. Establishing such a standardization framework could act to promote confidence in this market; enabling customers to make due comparison between market alternatives including suppliers and products emanating from different EO platforms.

Question 7) Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No comment

Question 8) How can geospatial data and applications be used to support enhanced roll-out of future technologies?

16. There are many dependencies between geospatial data and future technologies. Current examples include Connected and Autonomous Vehicles and smart assets. Standardization services can provide a framework of how geospatial data can support the technology roll out. BSI already works closely with government and industry stakeholders to identify strategic standards solutions in areas of emerging technology, examples include, landscape mapping, roadmaps for standards development, mechanisms of standard uptake as well as creation of standards themselves.

Question 9) What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

17. See answer to question 11.

Question 10) What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

No comment

Question 11) What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

18. Historically quality and trust in geospatial data has existed in public bodies, there now needs to be a mechanism to replicate this level of trust for the private sector if they are to play a substantial market role alongside public sector actors. In market verticals such as BIM, Smart

[4] https://science.nasa.gov/earth-science/earth-science-data/data-processing-levels-for-eosdis-data-products/

Cities, IoT we have seen geospatial data considered differently and new ecosystems of data collectors and data processors emerging – especially in relation to positional data. This has raised questions related to the authority of the data and what can be trusted and relied upon.

19. Public data providers cannot serve all potential market areas for geospatial data. At the same time public data providers will derive (and rely upon) much of their positional data through an increasing cloud of connected devices. What is needed is a mechanism that allows a richer ecosystem of public and private providers of geospatial and positional data to interact. Standards could be used to define the functioning of this interaction. Crucial to this are standards that can be used to certify 'authoritative data' from other data. Such an intervention will have a number of advantages:
    i. It allows for innovation. Open data can be freely used and new applications tested without any certification
    ii. It allows for markets to form. A trusted data service offers reduced risk to consumer of the data, which can be more easily governed contractually and backed by insurance if necessary.

Question 12) Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

No comment

Question 13) How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

20. The Geospatial Commission is well placed to develop an over-arching strategy between various sectors. Standards can support implementation of cross-sectoral and consensus driven international solutions.

Question 14) Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comments

Question 15) How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

21. Standardization provides a mechanism to reach documented agreement on differences between UK and National variations. Using standards regional and national differences can be accurately reflected in any applications using the data and required, for example, aggregation of national data to form a UK wide view. Existing BSI committees could manage the development of these standards.

Question 16) How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

22. See answer to question 11

Question 17) As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

No comment

Question 18) Are there any other areas that we should look at as a priority?

23. Not at this point, the list is a good first set of priority areas.

Question 19) What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

No comment

Question 20) How best can we make the UK's presence in the international geospatial world more visible?

24. Application areas like BIM and Smart Cities. Through its standardization activities, the UK is recognised as a leader in application areas for geospatial information such as BIM and Smart Cities. However each of these new and emerging sector areas take geospatial data as a secondary consideration.
25. Coordinate a better approach to geospatial and positional data to underpin new and emerging market verticals that would bring application areas of geospatial data to the fore. Currently this is undertaken in industry groups such as the Open Geospatial Consortium (OGC) and also through the implementation of INSPIRE. Following Brexit, UK's influence over INSPIRE is to be determined and so the UK should look to take a stronger and more active role in defining the data standards that can be used across market verticals. Practical steps could include better representation on committees and BSI perhaps formally part of GI commission, in particular to provide input on the increasing market verticals for geospatial and positional data.
26. There is no international coordination for geospatial data application areas. As mentioned in the introduction, such responsibilities are fragmented across individual market sectors where geospatial data is not the primary consideration. This has resulted in inconsistencies as to how geospatial data is generated and documented. There is an opportunity for the UK to take a lead on developing international approach to the application of geospatial data.

Question 21) Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comment

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Background on BSI

BSI is the UK's National Standards Body, incorporated by Royal Charter and responsible independently for preparing British Standards and related publications and for coordinating the input of UK experts to European and international standards committees. BSI has over 115 years of experience in serving the interest of a wide range of stakeholders including government, business and society.

BSI represents the UK view on standards in Europe (via the European Standards Organizations CEN and CENELEC) and internationally (via ISO and IEC). BSI has a globally recognized reputation for independence, integrity and innovation ensuring standards are useful, relevant and authoritative.

BSI is responsible for maintaining the integrity of the national standards-making system not only for the benefit of UK industry and society but also to ensure that standards developed by UK experts meet international expectations of open consultation, stakeholder involvement and market relevance.

British Standards and UK implementations of CEN/CENELEC or ISO/IEC standards are all documents defining best practice, established by consensus. Each standard is kept current through a process of maintenance and review whereby it is updated, revised or withdrawn as necessary.

Standards are designed to set out clear and unambiguous provisions and objectives. Although standards are voluntary and separate from legal and regulatory systems, they can be used to support or complement legislation.

Standards are developed when there is a defined market need through consultation with stakeholders and a rigorous development process. National committee members represent their communities in order to develop standards and related documents. They include representatives from a range of bodies, including government, business, consumers, academic institutions, social interests, regulators and trade unions.

Further Information

BSI would be pleased to provide further information or to discuss the content of this submission with the Department for Transport. For further information please contact:

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Broxtowe Borough Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Include a broad range of GI skills at all levels in the education system, i.e. mandatory modules on geography related degrees but also at school and further education levels. This should include but not be limited to cartography, analysis and data management. The 'pretty map' aspect is a result not the start but often it's perceived as the only purpose of GI. Some inclusion and mention of GIS in Information Technology courses throughout the spectrum would also be advantageous.

Information and guidance on emerging technologies that is quick to access and understand for current professionals is sorely lacking. For example, the advent of web-technologies in the last ten plus years has been accompanied by a dearth of official guidance. If you find you need to know it, you spend time looking online or emailing other busy colleagues who may or may not have run into the technology before. As technology changes it is simply assumed that those in post will know all about it, how to use it and what that consequences are. Officers in different organisations are all taking time to find the same websites, the same information and investigate the same technologies. This means public money is being spent many times for the same end. Local knowledge sharing between organisations is key to continual expansion of skills yet that generally only happens on an ad hoc basis. There aren't many training conferences happening and those that are, are difficult to justify to some managers because of a lack of recognition for the profession. Continuing Professional Development schemes (CPD) generally aren't recognised.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In many organisations GIS is seen as a job rather than a career. At best there might be an assistant and an officer post. Combined with a general lack of understanding of the breadth, complexity and detail of the work there is no chance of a career. There are no recognised markers nor understanding that GIS is so broad that anyone with experience can't just take over exactly where someone leaves off. Often the skills have been developed by what that organisation requires to a greater or lesser extent. There's nothing that states that a GIS Officer must have skills A, B and C ideally with skills X, Y, and Z. This sort of situation means that employers often overlook the intricacies and interlocking nature of skills. At Broxtowe we don't use routing analysis because the software extensions, and therefore the skills to use it, aren't there but we do use a lot of automation, however elsewhere the reverse might be true but were the GIS Officer to leave then there would be an assumption that the new incumbent would simply know how to keep everything running, just because they've presumably had GIS experience elsewhere, even though that experience may just be data capture or cartography. If a admin officer leaves, generally the work is such that it can be easily documented into a process. Because of the fluid case by case nature of GIS projects, although you can document a project, a process, there's a far more complexity, you have to work out the process from a myriad of options before you can even test the hypotheses. An admin post, a generic officer post

will probably need to know how to use one database, a document management system and the normal office suite. A GIS Officer post can need to know how to interact with many databases, programming languages, document management systems, web technologies, GIS software (including the analytics, cartography and data management) often not just one GIS but several, especially with the advent and popularity of open source alternatives ever more prevalent. Not to mention an understanding of licence agreements, memorandums of understanding and even EU regulations.

There is always the need to secure some sort of funding, whether internal or external. This may not be a skill but it's certainly a need. Without recognition of some description councils will continue to haemorrhage the current skill base and the continued improvement will stagnate. A lack of funding doesn't just mean that systems are stagnated but also that empty posts remain empty and are often marked for redundancy / deletion. As an example, an assistant post was agreed for GIS at Broxtowe, this is now becoming an apprentice post because of lack of funding and there is the possibility that it will not be filled at all. That is certainly a gap because it leaves GIS skills vulnerable. The lack of funding / recognition for the system itself can often result in underutilization simply because licences cannot be purchased to increase usage.

In the world of local government, GI is a new phenomenon. There are decades of experience in HR departments and management as to the roles and responsibilities of many other posts but there is next to nothing for GI. GI people are ones who move points around on a map, produce red-line plans, make strategies 'look pretty'. If there is any further understanding it's normally along the lines of 'It's just a case of pressing a button, isn't it?' Very few people outside of the job understand its complexity because as soon as you try to explain it you're 'talking jargon' or 'being too technical'. High level guidance to explain the world of geospatial and geographic information from a trustworthy source is sadly lacking.

This sort of guidance could serve a dual purpose, not only explaining from an independent source the concepts and skills but also in helping the recognition that GI professionals are just that, professionals, and that helps the 'job' become a recognised career.

Having a nationally recognised career structure would be advantageous, especially for smaller organisations. Often a lone voice can be viewed as selfish but that doesn't mean that professional recognition should be forgone. Currently although there can be professional recognition from organisations such as the AGI they don't mean anything and don't result in any recognition within organisations. This reinforces the concept that the job is just an admin grade post, with any admin grade person able to undertake all aspects of it.

There is the saying that 'you don't know what you don't know'. Without some sort of guidance about what the roles should and do entail, it is very difficult for anyone to say confidently what gaps there are within organisations.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One common request from users at Broxtowe is for drainage and sewerage maps. These used to be provided on OS map sheets in paper form, however with the advent of geoportals these are now only available via an online portal to which you need to log in on a frequent basis, with any request for the data being turned down as being too risky for the originating organisations. This data would be used ahead of invasive works and a simple secure web feature service could overcome many of the concerns expressed by the originating organisations. If it's their data from their servers it is no different to viewing it on the portal, however it removes levels of admin and frustration from users, saving time and potential errors caused by frustration.

There are many datasets held within the public sector that could benefit from being combined on a national level for easy access and downloading. Layers such as public rights of way, school catchments, housing allocations etc. These layers are currently held in different schemas and formats causing issues when merging them together. A national schema for such layers would make this far easier but a national database taking updates, merging them together and pushing them back out for download as national / regional layers would be even more advantageous saving organisations time and resources dealing with multiple agencies, organisations and systems. Licensing restrictions could be eased by getting Ordnance Survey to agree to the schema and capture scale for such data. The Brownfield Land Register is one example of where this sort of idea has been partially implemented. A set schema and capture scale helps improve the quality of the capture.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

UPRNs are currently stored as numbers in a text field to a length of 12 significant digits, often these contain leading zeros – i.e. 012345678912 – which get stripped off when exporting or linking the data – i.e. 12345678912. The simple addition of a letter – i.e. A – at the front of these numbers would prevent this stripping. Meaning that linking data together becomes seamless as opposed to often requiring human intervention to replace the zeros stripped off.

There is general confusion for the public about whose address is right when Royal Mail use a different town. For example, in Broxtowe we have Beeston, Chilwell and Toton in the LLPG but Royal Mail only recognise Beeston. Therefore, people in Toton will sometimes have mail that is addressed as Beeston. This confusion has arisen because there is no statutory ownership of the middle of the address.

Then there's the fact that there are two different acts under which local government can name and number properties with differing views on what is duty or a power. Maybe it's time for one statutory instrument that states responsibility of the responsibility for each part of the address and the duty, power or responsibilities of each organisation.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

-

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

-

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

-

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Funding and statutory requirement for the process.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

A comparable one to other sectors, whether that is by the provision of expertise or by helping with infrastructure and funding.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

From Q4 above
There are many datasets held within the public sector that could benefit from being combined on a national level for easy access and downloading. Layers such as public rights of way, school catchments, housing allocations etc. These layers are currently held in different schemas and formats causing issues when merging them together. A national schema for such layers would make this far easier but a national database taking updates, merging them together and pushing them back out for download as national / regional layers would be even more advantageous saving organisations time and resources dealing with multiple agencies, organisations and systems. Licensing restrictions could be eased by getting Ordnance Survey to agree to the schema and capture scale for such data. The Brownfield Land Register is one example of where this sort of idea has been partially implemented. A set schema and capture scale helps improve the quality of the capture.

After the initial 'You want us to do what? By yesterday and with no money…You've got to be kidding' response, the implementation of schemas and recognised scale capture, ideally projection as well, should reduce inefficiencies and improve interoperability of data across the public sector and private sector customers of that data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Champion the use, distribution and take-up of geospatial information and technologies.

Provide guidance from the strategic to the technical level for all matters relating to geospatial and geographic information, including new technologies

Continue to oversee national licensing agreements and terms, potentially even developing a standard national license for geographic data.

Recognise and champion the public sector as a major player in the geospatial landscape of the UK and that the well isn't bottomless.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The old saying that 'you don't know what you don't know' rears its head here. Without a national register of geographic datasets, how are we meant to know what data could be available and what benefits could, therefore, be derived?

From Q4 above:
One common request from users at Broxtowe is for drainage and sewerage maps. These used to be provided on OS map sheets in paper form, however with the advent of geoportals these are now only available via an online portal to which you need to log in on a frequent basis, with any request for the data being turned down as being too risky for the originating organisations. This data would be used ahead of invasive works and a simple secure web feature service could overcome many of the concerns expressed by the originating organisations. If it's their data from their servers it is no different to viewing it on the portal, however it removes levels of admin and frustration from users, saving time and potential errors caused by frustration.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Communication and compromise.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Encourage the formation of regional user groups and a register of expertise within the sector. So many small public sector organisations are existing with little or no GI expertise and often don't know where to turn (other than Google to access it).

Encourage technical papers as opposed to case studies. The actual how instead of the what.

Utilise already existing networks such as the Knowledge Hub to communicate in a post GDPR landscape but do not water down the communication by having too many different methods with the expectation that everyone will monitor all of them.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

-

Q18: Are there any other areas that we should look at as a priority?

-

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

-

Q20: How best can we make the UK's presence in the international geospatial world more visible?

-

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

-

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	CACI Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The items listed make sense, but it is our view that Geospatial is more than landscape and built structures and extends to population, society and the geography of consumer behaviour.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We have strong geospatial skills within the organisation. There is a growing requirement for processing of very large datasets and these require knowledge of a range of programming languages for example python, as well as database and big data technologies.

Skills training and careers could be promoted via recognised industry bodies.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Open National Address File (with geospatial element)
A standard, universally recognised address list available as an open dataset would be very benenficial, particularly if supported by accurate geospatial referencing. The value of this would extend across many areas from understanding consumer movement, transport planning, resource planning, and linking these to the private sector without barriers to entry caused by different address definitions or the cost barrier of licensing.

Lookup between PAF UDPRN and UPRN
If this were available as open data it would greatly assist in supporting our public sector clients and also enable us to exploit the value of an open UPRN with co-ordinates dataset

Land Registry INSPIRE property polygons
Royalties for commercial use make this challenging to use.

Public Transport timetable data
This is currently only available in a very complex form and is very time consuming to extract and exploit. We also have issues with data quality.

Workplace population
Regularly updated estimates of worker population at a low geographic level (e.g. workplace zone) would be of a lot of value in understanding the changing demands for services in an area. Currently we only have census data from 2011, which by the time the next census is released will be at least 12 years old. The LSOA estimates from BRES are too high level and we believe not always that reliable/plausible for local analysis being based only on the BRES survey. Could the IDBR be used for this sort of application?

DVLA licence plate to postcode/OA file
For understanding shopper catchments & demographics – almost all our clients have ANPR and capture licence plates (including local councils). If you were able to code them with a geodemographic classification and map them at a non-PII level eg OA, then councils could use it for bus route planning, increasing public transport etc. Owners of shopping centres could better understand who is visiting.

Oyster Data
Data from Oyster and other regional travel card data (e.g. Nottingham has a similar system to Oyster), in order to understand trip patterns and demand for services both in transport planning and ancillary services e.g. retail.

Census workplace flow data and Census small area micro data
Easier access to these would be beneficial. Currently these datasets have limited access due to disclosure control, which differentially impacts on private sector users.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A standard, universally recognised address file in the public domain as open data would be very benenficial, particularly if supported by accurate geospatial referencing, for linkage with other emerging datasets e.g. mobile app data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

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Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Computer Aided Development Corporation Limited ('Cadcorp')
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
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Medium business (50 to 250)	
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Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Your view of the geospatial data types are accurate and provide a good summary of the different geospatial data types that are used within the UK geospatial sector.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

When deciding the skills to focus on, it is essential that the outcome does not impede a competitive market for commercial data, software and service suppliers. A competitive market allows the public sector to benefit from innovation and drives quality and value.

Experience has shown that on occasions when certain sectors focus on developing skills in a single geospatial software package, the supplier may no longer have the same incentive to invest in product development and provide a competitive price. Examples of this can be taken from some of the National Strategy for Police Information Systems (NSPIS) contracts awarded between 1998 and 2010.

Likewise, government endorsement for a single technology set can deter private sector suppliers from investing in potentially competitive systems.

Government policy should focus on developing those skills that are open, transferable and complimentary to other sectors of the IT industry.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Interest in careers in the geospatial sector starts at school. The government should ensure that geography at least maintains its place in the national curriculum.

When students reach the workplace, the geospatial skills we require include:

- Fundamentals of GIS and Geography
- Programming
- Web management
- Scripting skills

It is no longer possible to be a geospatial specialist without additional IT skills such as basic programming and scripting, database and SQL knowledge and an appreciation of web services,API capabilities and functionality. Basic IT architecture and principles of networks, domains, security, cloud computing and firewalls are all invaluable.

In many circumstances, GIS is a branch of IT, albeit one which interacts with a range of other systems, services and architectures.

Geospatial specialists need to understand how to address a spatial problem with the tools at their disposal. This requires an analytical mind with an ability to visualise the solution, based on the abilities and limitations of the infrastructure and systems available.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Feedback from our customers about datasets that they find challenging include utilities data such as Electricity/Water/Gas/Broadband boundaries, networks and assets and hazards. Our customers currently need to contact each supplier separately for data. If they are able to access the data it is of varying quality and consistency. A National Joint Utilities Group data set would help solve this challenge.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

As noted in the response to Q2, when deciding which new technologies to focus on, it is essential that the outcome does not impede a competitive market for commercial data, software and service suppliers. A competitive market allows the public sector to benefit from innovation and drives quality and value.

Experience has shown that on occasions when certain sectors focus on developing skills in a single geospatial software package, the supplier may no longer have the same incentive to invest in product development and provide a competitive price. Examples of this can be taken from some of the National Strategy for Police Information Systems (NSPIS) contracts awarded between 1998 and 2010.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications have a key role to play in the roll-out of future technologies. Data suppliers need to ensure that they supply data based on standards that have been defined and certified by the Open Geospatial Consortium. Similarly, software suppliers need to provide applications that can support those standards. Adopting open standards is key to ensure a competitive UK geospatial market that allows customers to benefit from the best overall quality and value.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The PSMA has provided an excellent mechanism to allow the public sector access to spatial data, especially data provided by the Ordnance Survey. Cadcorp would support the continuation of the PSMA (or similar) as a means to invest in geospatial data assets.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a key role to play in enhancing the UK's geospatial data assets. Competition within the private sector is key to driving innovation and ensuring the best value to public sector customers.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

One challenge we have faced when working with geospatial data from the public sector is in their persistent use of proprietary data formats or in their assumption that end user organisations are using systems from a limited number of providers, when, in fact, many diverse systems are in use every day. Users of these diverse systems are not provided with any assistance in the creation of cartography. This has the effect of increasing costs for those suppliers who are not 'in the club'. It also stifles innovation and acts as a disincentive for suppliers to invest in the sector.

The Geospatial Commission needs to consider the role of crowd sourced and commercially harvested data to complement professional field based surveys. This can add significant value to the consumer. For example, Google collects data (such as traffic flows, busy times in shops, museums etc.) through collecting spatial and location information from Android phones, in real time and through vast numbers of people.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Points of Interest data OS – Our customers have requested that it is included in the PSMA https://www.ordnancesurvey.co.uk/business-and-government/products/points-of-interest.html

Water Network – Our customers have requested that it is included in the PSMA https://www.ordnancesurvey.co.uk/business-and-government/products/os-mastermap-water-network.html

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

A single strategy needs to provide a competitive market for commercial data, software and service suppliers. A competitive market allows the public sector to benefit from innovation, drive quality and value and support regional variations.

Where appropriate the single strategy should define the use of standards from the Open Geospatial Consortium or access to data through open API's. This will allow sectors to share data while still supporting regional variation in software and service suppliers.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

In our experience local authority and other public sector GIS employees appreciate the opportunity to network with their peers and to receive updates from the private sector.

The Geospatial Commission and their stakeholders are ideally placed to facilitate these networking opportunities by arranging regular industry events in partnership with both public and private sector suppliers.

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- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

When deciding what geospatial applications are scaled-up or developed, it is essential that the outcome does not impede a competitive market for commercial data, software and service suppliers. A competitive market allows the public sector to benefit from innovation and drives quality and value.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Calderdale MBC
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**x**
Large business (over 250 staff)	
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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Not sure if services are a specific data type (they would contain data though?)

If including services in terms of definitions, is it worth considering a definition to what location intelligence is? (ie one of the main outputs for storing/managing spatial data?)

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Promote use of GI (Geographic Information) as ‘normal’ ie try to remove some of the stigmas associated. Embed geographical data learning / education within schools so it becomes commonplace.

Work closely with Local Government to ensure the breadth of GI is recognised, then develop the skills needed to support the Local Gov functions. This will help ensure GI is used in evidence based decision making processes. Culture change is needed, as well as pure working knowledge of GI and it’s benefits. Ie, there is a need to ensure data (not just geo-data) is recognised as an asset, promoting ownership and importance of data quality across all areas of Government.

Can more be done/supported by the commission to enable/facilitate collaboration. For some that would be regionally, but may also extend to joint ventures between not for profit organisations, commercial sector, voluntary sector.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

General awareness of GI principles / benefits need realising, to then be supported with more skilled GI professionals, to help embed GI within any organisation. GI needs all elements (infrastructure, skills, training, systems, data, output, analysis) to work together effectively for the benefits ro be realised, so close links with IT development / infrastructure teams / transformation teams / digital teams are all needed.

Eg. you can have highly skilled individuals, but without the data/systems it would not be productive. You can have excellent data/systems, but without skilled users it would not bring benefits.

You can have skilled users/data/systems that can still fail without relevan buy-in from senior management to promote change to different ways of working, ie putting GI to effective use.

Is there potential to have more available and recognised training? Currently it’s only academic routes that are on offer. Eg nvq or equivalent, on the job training etc.

We talk about making GI less special, but this can lead to a dilution of already stretched resource in this area.

Within Local Government Authorities, knowledge of GI is usually down to one or two individuals that spend most of their time keeping the ‘wheels on the bus’. Resource needs to be increased to allow the specalists more time to develop systems, strategies, processes to use GI more effectively, do more analysis etc.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

OS data is of high quality but difficult to use - effort is duplicated across all Local Government pre-processing for use. This could al be done at OS, by providing commonly used file formats such as .TAB, .SHP or web services. Many LA's would be more than happy to simply use 'vanilla' mastermap out of the box, than spend a lot of time and money simply getting ready to use, which means less time for added value work. There needs to be some encouragement of system suppliers to modernise the way they consume base map data at the same time. The GI resource has to support all systems that consume OS data, and would still have to support all systems, so developing new ways to consume the data is only half of the battle.

OS Points of interest could be really useful but restrictive in use. Again, lots of duplication of effort where everyone is collecting the same information.

Land registry data – more openly available and at less cost.

Sort out licencing issues with Postcodes.

Modern 'historic maps' don't seem to exist, so we now have a gap of ready to use historic data. OS should create raster imagery of newer historic maps from 1980s onwards to allow for continued use. No one has time to do this themselves but sure many would benefit.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Consistency needs to be agreed on how to move forward on LLPG/Address Base / Postcodes.

If Local Government are key to providing, updating and maintaining LLPG, which subsequently feeds the other address databases, then it needs to be recognised and resourced properly.

A central support service should be created to help all uses match addresses to NLPG/Address Base. This would increase the accuracy of all address data. EG a tool that matches address lists and adds the UPRN to input datasets, suggests close matches etc.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

APGB is a great start, which should continue, with regular updates to standard Aerial Photography imagery. Other types of imagery is also useful but needs to be more readily available and accessible – see previous points around making data readily consumable.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Things that allow the data to be used and consumed more readily. Software that allows for better integration of systems to allow different systems to use the same data – maintain once use many.

New opportunities will arise through this, which will help both public/private sector

Support for new business start-ups, to allow use of spatial data without prohibitive licencing at the start of the use (ie time limited access perhaps), If the start up is succesfull then relevant costs can then be applied.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Location/integration become more common place. Ie everyone has the option to view location data spatially, which will bring to life the data.

Eg easy integration to plot location data to see on a map, or the system does this in the background.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Support/promote buy-in from senior management levels that this needs to happen – not just in principle but in practice.
Funding for development projects in this area.

Investment needs kick-starting - pre-austerity there was momentum building on the use and benefits of GI. This investment has declined since, and may need to start again, before it can continue.

Centrally there could be a push to promote open source - eg fund development and training of QGIS which reduces cost. Promote open data, with reduced restrictions on OS derived data publishing.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Consider a model that seeks agreement that some private sector data can be made open, without giving away core business information – similar to Ordnance Survey.

OS have to make a profit, but also have to share data, which hopefully can add value as well as income.

If this model works, can other large private sector organisations follow?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Make OS data more usable 'out of the box'
Less restrictive standards / definitions. Eg OS derived data publishing restrictions.
Wider use of ETL software - standard ways / tools to translate from proprietary systems.

Metadata standards but not so they become prohibitive.

Standard portals to access open data geographically - ie much better than data.gov.uk

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Sort out addressing issues with Royal Mail
Promote the use of NLPG across all gov departments so we all contribute to maintaining one master dataset. Eg NLPG should replace Electoral roll address data.

Reduce licencing of OS data
Make OS data more readily usable.

Understand core GI functions across all LA's and look at efficiencies by standardising tasks that all LA's have to do. Break down barriers between public sector data and private sector data - Local authorities need access to a range of data from both sectors.
The Geospatial Commission should pick up any cross sector challenges to allow LocalGov to just use data for the public good. LocalGov has to manage data from a number of hubs, media supplies etc, leading to data translation, which is not lean, eg OS Data, Land Registry, Environmental data (Coal/hazards), Utilities Infrastructure (YW/NGN/NPG), Royal Mail,

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Access to land registry data (via web service perhaps) which would save a lot of money and time having to put individual requests in for ownership of land parcels. This is used across many different departments, such as environmental health, highways, countryside, rights of way, planning enforcement.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

A consistent vision of normalising spatial data, and how we collect it as a public body at almost every channel, but don't know we are doing it and not mashing all this data together to realise / unleash it's potential.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Better access to more usable OS data, that is less restrictive with derived data licencing.
Better platform for sharing GI data – ie a GIS platform that is designed for this purpose instead of just somewhere to publish data that happens to be spatial.
Promotion of ETL software and offers to share best practice around different data formats etc.
Requirements for suppliers to be more GI aware to allow for better interoperability of spatial data maintained in service specific solutions

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Join people to place – GI within social services and the 'people' directorates within Local Gov are still large areas for development. Eg joining people identifiers (NHS number) to place identifiers (LLPG UPRN) would open potential for deeper analysis.

Mobile working – location based information feeding in to mobile devices allowing seemless integration with main office based systems. Overcoming the requirements to store large volumes of spatial data locally, synchronising on/offline.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Promotion of the new commission when formed – with buy in from existing well known institutions such as the OS, BGS, RGS etc. to create on voice, promoting and sharing best practice

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	CEDA, RAL Space, STFC
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Research Council**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Seems ok

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

At CEDA we currently ingest all Sentinel data from ESA's Collaborative Hubs – and make them available to the academic community for their research.

Access to these Hubs is critical to continue to provide this service – reducing duplication of effort at the very least, but more likely enable important and in some cases world leading climate research to continue.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Ensure reliable and securely funded routes to large-scale EO data access; access to storage and analysis infrastructure.

Note that Earth Observation data is not only "images" – the data can be quite complex, and require sophisticated processing algorithms to convert into "usable" information (eg from radiance spectra to ozone maps).

This requires appropriate (scientific) expertise, but also data storage and computation resources.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Currently NERC invests in CEDA and JASMIN to provide access to Earth Observation (and other climate and environment) data and a co-located analysis environment for the research community . This community themselves produce new geospatial data assets – e.g. Essential Climate Variables, using satellite datasets and auxiliary data (met data; reanalyses), processed with scientific through to operational algorithms. These activities are typically funded by ESA and EU.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

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- **mobility**
- **natural resources**

- **sales and marketing**

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Q18: Are there any other areas that we should look at as a priority?

Climate and environment

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	CREST Geospatial Special Interest Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Charity or social enterprise	
Individual	
Legal representative	
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Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

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2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The types of data seem broadly appropriate, but there is general consensus among the group that the terminology is confusing, especially the definitions of geospatial and positional data used in the consultation document.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

It is important that geospatial skill straining strikes a balance between understanding of fundamental principles of geospatial data collection, quality assurance and analysis alongside the more specific and applied skills required by the broad range of industries requiring these skills.

The open geospatial movement has gained significant momentum in terms of both software and data. The is a significant opportunity for the UK to be at the cutting edge in the development and use of these products.

Other recommended areas of focus include cartography and data visualisation, required to ensure the insights gained from large and complex datasets can be communicated effectively. Also, skills in data management and storage, including understanding of data quality and metadata, required to maximise the benefits of large datasets and ensure appropriate use and reuse of datasets.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

A particular gap has been noted in the availability of qualified land surveyors. Apprenticeships at L3 and L6 are being developed which may help rectify this, and these should be supported. A broader shortage of skills across the geospatial sector is also identified. This can be addressed at a number of levels. Firstly, through CPD training to provide the necessary skills within the workplace, and also through engagement with schools to raise awareness of the opportunities available within the geospatial sector. Programmes such as Design, Engineer, Construct (https://designengineerconstruct.com/) are being rolled out, but currently have limited reach and could be expanded. The Marches LEP attempted to recruit a school locally but struggled to do so.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Collating of many datasets currently collected at local authority level or similar (e.g. public rights of way, tree preservation orders) would also be valuable in enabling national scale projects.

While some environmental data is being distributed effectively (e.g. LiDAR), other datasets such as abstraction borehole data still remain difficult to obtain in usable, digital formats.

Access to utilities data in a more easily accessible and consistent format would be of benefit to a range of organisations, particularly those involved in property development, and would help avoid unnecessary costs involved in re-surveying areas.

Access including visitor numbers and times from Google Maps and Strava heatmap data could provide valuable tools for planning and developing services, including public open spaces. This would be of particular interest to local authorities.

Species and biodiversity data are often difficult to access in a consistent and usable format.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Despite some open datasets emerging, improving accessibility of high-quality address and postcode area data would open up a huge array of opportunities. This would allow for many 'positional' datasets held by businesses to be converted into 'geospatial' datasets, allowing for greater value to be obtained from the data. Users noted limitations to current address data when available, including the desire to differentiate between use types. The potential benefit of a three-dimensional aspect to address data for future applications relating to multi-story buildings for supporting developing technologies may also be beneficial.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

A key issue post-Brexit will be maintaining involvement with the ESA and a role in their initiatives i.e. the Copernicus programme, GALLILEO, and other future initiatives. Support will be needed for both academic institutions and the UK's own commercial space industry will also help to ensure that the necessary skills and expertise are developed and maintained to keep the UK at the forefront of the field.

The release of the Environment Agency's (and regional equivalents) archives of LiDAR data and imagery has provided a valuable resource for many applications in the UK, and this should continue to be maintained and enhanced further.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Ensuring use of the latest open standards in relation to maximising the usability and value of geospatial data.

Investigating options to enable access for organisations to high performance computing necessary for analysis of increasingly large geospatial datasets.

A need for improved sensor networks has also been identified, covering areas such as flooding, water quality and air pollution. These would support a range of applications in improving public health and safety.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Access to many of the datasets already discussed will support the rollout of technologies including building information modelling (BIM), and smart-cities. Providing the necessary geospatial infrastructure will allow the UK to remain at the cutting edge of these technologies, the output of which are of global interest.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

It is noted here that while open data is valuable, care must be taken to ensure that the production of high-quality datasets is sustainable and that the requirement for data to be open doesn't have a detrimental effect on the quality and completeness of datasets. An example is ecosystem and biodiversity data collected by Natural England, which while heavily supported by volunteers still incurs costs to coordinate and check. As a result of the opening up of some of the data, investment in the program has been heavily cut and in turn a reduction in the quality and volume of data collected has been observed. A small amount of investment in areas such as this could lead to much greater benefits resulting from the data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

There is a need to have permanent geodetic networks set up which are consistently updated from one central source. This would lead to substantial saving in the long run by reducing unnecessary repeated surveying.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector will have an integral role in defining needs and requirements of geospatial infrastructure and adding value to existing data assets. Encouraging private sector organisations to collaborate and open datasets for re-use where possible and appropriate may be one approach and could lead to a reduction in costs overall. However, other models for collaboration also need to be investigated. An example is surveying work carried out during large development projects could be fed more directly into other datasets such as OS mapping, reducing the need for repeated surveying and therefore cutting costs.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

One of the biggest challenges is fragmentation of data collected at a local scale. Many organisations we work with are trying to produce products and services at a national scale, but while data is available it is often at a local authority scale. The challenge involved in collating the latest datasets from all authorities across the UK is often prohibitive. Having consistent standards for collection of common data such as public rights of way, tree preservation orders (TPOs), local planning information etc would be a starting point in improving this. While much of this data is held on data.gov.uk, there is also no simply way to search for, for example, the latest TPO data from all authorities. Comprehensively identifying common datasets and making them easily searchable and accessible would vastly increase the value of the data.

Similarly, a joining up of cross-boundary datasets is required, acknowledging that many processes (particularly those linked to natural systems) do not stop at borders and need to be considered holistically.

Improving metadata will be one key step to achieving this. While the Inspire metadata standard is intended to have been implemented by public sector organisations, this does not appear to have been universally accomplished, and may need to be further supported and incentivised.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The public sector could see particular value in some of the aforementioned datasets provided by large organisations such as Google and Strava, which would provide a valuable tool in supporting their services and operations as well as in developing novel tools. The Geospatial Commission may be an appropriate organisation to open these negotiations in releasing this kind of data for wider benefit.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Usage data and visitor numbers, such as those displayed in Google maps, along with possible traffic data as well as activity data such as the Strava heatmap. These would allow novel approaches to identifying patterns of usage and needs within local authority areas, such as gaps in walking/cycling provision or stress points within networks and services that have not been identified by other measures.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

While no specific recommendations have been made by the group regarding regional variations, the importance of considering the rural economy should also be noted. Developments should consider the significant role that geospatial is likely to play in industries such as farming, with the rise of precision agriculture supported by developments in remote sensing and drone technologies, as well as supporting software.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Building information management (BIM), smart cities, autonomous vehicles, precision agriculture

Q18: Are there any other areas that we should look at as a priority?

Health and wellbeing – both from a public and private sector perspective. This is a growing sector with huge economic value.
Tourism – possible as a focused sub-category of sales and marketing

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Building information management (BIM), smart cities, autonomous vehicles, precision agriculture

Q20: How best can we make the UK's presence in the international geospatial world more visible?

This could be improved through funding innovation to ensure that the UK remains at the cutting edge of these developments as well as supporting training and research, to encourage individuals and organisations internationally to view the UK as first choice for obtaining the skills and knowledge they need within the sector.

This may be aided by the development of one or more centres of excellence, something which Shropshire is already investigating through collaboration between academia, private sector, public sector and third sector organisations, to capitalise on its existing cluster of high-tech and geospatially focused companies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

CGI Response to *National Geospatial Strategy – call for evidence*

Key points

As the 5th largest IT services company in the world we operate across a broad range of industries, including:

- Communications
- Financial Services (including banking, financial markets, and insurance)
- Government (including local government, secure cloud, law enforcement and justice)
- Health
- Manufacturing (including aerospace and automotive)
- Oil and Gas
- Retail and consumer services
- Space and Defence
- Transportation and logistics (including aviation, highways, intelligent transport, rail, post)
- Utilities

We have a network of geospatial professionals, embedded across the business, with over 500 members in 13 countries. We therefore take a broad view on the usefulness of different geospatial technologies which we incorporate in wider business solutions. From our perspective we would like to highlight the following key points in our response:

1. Making the UK a world leader will only be possible through companies which are able to industrialize and scale-up digital geospatial technology.
2. The greatest social and economic value would be in enabling *all* of UK government and industry to make better decisions. Cross-sector initiatives should be driven forward, for example as part of the Space Sector or Construction sector deals.
3. It is essential to simplify access to data through platforms and visualization (e.g. AR), making geospatial information available to those *without* specialist skills.
4. We propose an Innovation Programme to experiment with data releases and new applications, potentially linked to the ISCF Wave 3 'Space Data Revolution' proposal.
5. The loss of industrial access to Copernicus and preferential access to data could be devastating for the UK's Earth Observation capability.
6. When defence is thinking of procuring imagery capability the ground segment, including software, is critically important to successful exploitation and this should be done in a joined-up way across Government.
7. Accurate and accessible geospatial data could be one of the keys to reducing the cost and schedule of 5G deployment in the UK.
8. It is crucial for the UK to have reliable access to robust Positioning, Navigation and Timing (PNT); indoor augmentation will be a future enabler for business.

We believe that the formation of the Geospatial Commission is a good start but there have been past initiatives; this needs to deliver as geospatial information will be a key part of all future technologies.

We welcome this opportunity to contribute to the Geospatial Commission and look forward to engaging on the substance of the strategy.

Point of contact: [Text redacted]

Q1: Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

In addition to Geospatial data, positional data, geospatial identifiers and geospatial services one may also consider data used for positioning or navigation (PNT) such as timing which is critical for geo-location but also for a number of other applications such as finance. The criticality of PNT for the UK economy has been highlighted by the Blackett Review[1] the Geospatial Commission should make sure that it interfaces with cross department activities in this domain.

Q2: In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

An aim of the strategy is to unlock the business opportunities of geospatial data and most of these businesses will be in the digital domain, particularly around fusing different geospatial data sets and their management. It will be critical to ensure that future geography graduates are familiar with all the latest digital tools and paradigms. It will be necessary to bring geospatial data management into the computer science curriculum (i.e. via geospatial data management modules).

There is a lack of surveyors within the UK (and those have an average age of 58), however we think it will be difficult for the government to act to fix this problem. Instead by helping to create a larger geospatial sector there should be a great pull and incentive for companies to promote these careers.

The role of (digital) automation in mapping and geospatial data updates is nascent today. We expect in the future machine learning techniques will become the dominant approach to processing updates from acquired data. The geospatial industry will be competing with every other industry for these skills (much as today, for example, we find it difficult to compete for experienced Java developers). It will be necessary for the geospatial industry to 'grow its own' as well as become a more attractive proposition for individuals with these skills. Making the UK a world leader will only be possible through companies which are able to industrialize and scale-up digital geospatial technology.

There is a lack of understanding of geospatial data (especially Earth Observation data) across government. We believe that part of the strategy should be to 'up-skill' the public sector alongside the private sector. Issues such as quality, data sharing and liability are likely to become more problematic and this needs to be a learning focus for all market actors.

Q3: What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We recruit specialist / subject matter experts and this is always a challenge. Roughly in order of difficultly to find, we look for skills like:

- Application / customer process development in a wide range of sectors like agriculture and construction leading to the ability to exploit and monetize capability (hardest to find)
- Atmospheric, oceanic, or land (processes) remote sensing analysis and algorithmic development

[1] *Satellite-derived Time and Position: a study of critical dependencies*, Government Office for Science, January 2018; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/676675/satellite-derived-time-and-position-blackett-review.pdf

- Satellite payload data ground segment (e.g. Copernicus, MetOp)
- Earth observation and GIS data management (e.g. ArcGIS)
- Machine learning
- 3D visualization
- Big data, cloud computing and virtualization (e.g. Hadoop, Spark)
- Software engineering / development and system integration
- User interface design
- Web technologies

Since there is only a limited pool of people with these skills it will be essential to simplify access and manipulation of data through data access platforms and abstraction making geospatial data more available to those without specialist skills.

Developing specialist skills requires a good understand of STEM subjects, well designed university degrees, and post graduate research opportunities. We are working with partners, such as Universities, to promote these but require support from UKRI. It is therefore important that UKRI is fully engaged with the Geospatial commission.

Q4: How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

The stated aim of the Geospatial Commission is to realize the social and economic value of geospatial data. CGI agree that there is a significant opportunity in unlocking this data and *the greatest social and economic value would be in enabling all of UK government and industry to make better decisions*. If we can improve the productivity of the construction industry for example, by reducing the number of incorrectly dug holes or reducing the time to survey a new plot, then the financial benefit could be quantified and it could benefit everyone (e.g. fewer traffic jams). But industry does not have the incentive to invest like this – it requires government to be proactive in terms of the support it offers and the regulatory environment. The problem is pernicious, even what should be a simple task like land searches is expensive, lengthy and uncertain (e.g. it is sometimes even impossible to identify who is responsible for a property) leading to unjustifiable friction in the economy.

Another major issue, recognized by the Geospatial Commission, is that software licenses are prohibitive. The GC should analyse databases, such as the PAF, to understand if the economic costs (evaluated properly and across the economy) outweigh the benefit of license revenues.

Numerous studies have shown the value of opening data-sets with a geo-spatial component[2,3] including benefits for both companies, the public sector and also achievement of global development goals. Johnson et al.[4] point out that “open” does not mean cheap, easy, or necessarily positive. CGI recognize that there can be significant costs to making data openly available and therefore recommend a cautious and evidence based approach to prioritizing data releases. Such an experimental and evidence-based approach could be achieved as part of a **Geospatial Innovation Programme** which, for example, could consist of:

[2] Science International (2015): Open Data in a Big Data World. Paris: International Council for Science (ICSU), International Social Science Council (ISSC), The World Academy of Sciences (TWAS), InterAcademy Partnership (IAP)

[3] OPEN DATA FOR ECONOMIC GROWTH, The World Bank, June 25, 2014

[4] The Cost(s) of Geospatial Open Data, Johnson et al., Transactions in GIS, 2017

- Identification / survey of all potential data-sources including those which exist today (across the whole public sector) which would be published as a catalogue. Assessment of issues such as quality, cost (including lifecycle) and privacy needs to be made in producing this catalogue. The catalogue does not to be comprehensive and could grow during each wave of the programme.
- Industry and academia would be invited to bid for competitive funding to develop pilot applications, identifying which datasets they need to use for their applications. As part of the selection process Government users could also indicate which applications they are interested in (and they would thus form a pilot community). The government users would also need to have funding to support the process and also to unlock the pilot data.
- The activities should be carried out all over the UK and not in a central location (because the business and government users are spread widely). However, the programme may include hubs such as the Geovation hub or an equivalent for Earth Observation to help support SMEs or provide a local base for the projects.
- The programme would include competitive funding for new potential data sources (such as IoT sensors on local government fleet vehicles, e.g. to detect pot holes or monitor the RF spectrum) as well as piloting new approaches such as qualifying surveyors to directly update OS MasterMap, following practice in other countries.
- A lightweight software platform (made free-to-use for government users) enabling (public) data providers to upload and manage their geospatial data, as well as industry/academia to easily develop processing and workflows.
- A robust evaluation process to establish the social and economic worth of the solution and recommend transition (and suitable internal government funding) to a full data release.
- Establish for each data release an update cycle (5-year-old data may not be very useful), quality framework, and licensing approach (ideally as open as possible).
- Cyber security should be '*baked in*' as there could be legitimate privacy concerns as well as potential value to global malefactors.

We believe that it is only by robustly testing each data release that the true value can be ascertained which is essential since the resources to release and maintain the data are scarce (both money and expertise).
Most recently InnovateUK has worked with industry to develop a proposal to the ISCF wave 3 called "Space Data Revolution". This could contain elements of a Geospatial Innovation Programme as well as an immediate route to getting started.

Two state-of-the-art examples currently under development by CGI based on earth observation data include a High Value Crop Monitoring service (HiVaCroM) and a Peatland Monitoring service (PASSES). HiVaCroM[5] will generate value for the economy by improving agricultural yield monitoring accuracy. PASSES[6] will allow private and public sector stakeholders to manage peatland in South East Asia more effectively contributing to the UN Sustainable Development Goals. Both rely on free-to-use Copernicus satellite derived data and the services have been developed under pilots similar to those proposed above. At macro level, CSIS estimate that Earth Observation adds $30 bn to the US economy every year (at a cost of around $7.5 bn). Much of this data is provided freely and this the same approach taken by the EU Copernicus programme. We believe that these examples demonstrate the value of open data which can be extended to the UK geospatial datasets and clearly demonstrate the economic, societal and international/export value of open geospatial data.

[5] https://business.esa.int/projects/hivacrom
[6] https://www.gov.uk/government/news/uk-space-agency-to-run-22mil-project-in-malaysia-indonesia

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes. There is currently a lack of confidence in the relationship between and the quality of address and boundary data. This could cause a problem for merging drone delivery technology where accurate shape data could be an important navigational aid.

Q6: How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

The UK has a highly advanced capability in the use of Earth Observation data largely grown from uses like weather forecasting and climate monitoring. It is now at the forefront of the commercialization of space data and research, for example with CGI working alongside universities and SMEs in EO exploitation projects. *The UK has the opportunity to be a global leader in the exploitation of EO data and its use with GIS, but the capability will only improve if it is commercially sustainable, e.g. making data available to everyone is difficult to justify if only a small community uses it, and does little to develop the market.*

We think that there are two mechanisms which the Commission can use: stimulate demand (directly – by acting as a customer, and indirectly – by encouraging take-up) and reducing barriers in a market place.

The government is in a position to stimulate demand by directly benefiting from EO data (as a customer) as well as encouraging its take-up by the wider economy.

Stimulating demand by direct government action

The Commission should take a focussed view and identify a small set of opportunities where the benefit of EO within geospatial is clear (for example within a Geospatial Innovation Programme), and then pursue those opportunities forcefully and at scale; tackling funding, culture, and regulation. For example, CGI is very supportive of the goals of the Space for Smarter Government Programme (SSGP) but problems persist in the size of activities (the projects are too small to be truly transformative) and their follow-up (there seems to be no consistent transition into usage by government). It would be better if there were larger projects which can be supported into their transition in government, which then acts as a powerful demonstrator for export. In particular, the competition phase should include an implementation within the respective government community (i.e. internal government funding) to overcome the 'valley of death' between development by the SSGP and take-up by government users. Whilst we fully understand the worry about '*single-vendor lock-in'* this concern can only ever be a barrier to innovation and public-private partnership. There is no reason to expect that once a use-case is demonstrated in the government exploitation phase that other commercial vendors will not be able to bid for follow-on contracts or operations.

In addition, the government could also look to stimulate contractors bidding for government contracts (e.g. construction) to innovate in their bids and include Earth Observation. Initiatives like the 'Construction Sector Deal' may even provide a mechanism to achieve this.

By creating a success stories, not only will technical capability be developed but also the experience of evaluating and deploying it for operations. By creating these success stories an effective market place will be created because it will create a real user pull leading to paying customers for which suppliers can then compete.

Defence, Security and Policing are all important users of EO data. The MOD is showing interest in acquiring more commercial imagery as well as developing its own sovereign space-based imaging capability (with the launch of Carbonite 2). Whilst we think that it is important for the defence and security community to develop its own requirements, we think that there is considerable value to be gained from a joined up approach between all government users. For example, commercial imagery acquired by the MOD could be made available to other government users (with appropriate licensing). Imagery obtained by the rest of government could be made available to the defence & security communities, and a common secure approach to data could allow for innovations in both communities to be shared. This could be underpinned by the fact that it is no longer the imagery capability which is so sensitive but how it is used (since commercial imagery systems are increasingly capable). The Geospatial Commission has an opportunity to develop a strategy with all stakeholders, particularly at the same time as the defence & security space strategy is being developed. In addition, the strategy should be broader than imagery and encompass the fusion of imagery with other geospatial data in a secure environment permitting interoperable platforms to be hosted in different secure locations with management of security credentials.

When defence is thinking of procuring imagery capability the ground segment, including software environment, is critically important to successful exploitation. Arguably this is especially the case if the procured capability is embedded within an environment of other data sources, such as those acquired from our international partners.

The funding model also needs consideration. The EO community is relatively small and already has access to co-funding streams. A direct procurement approach may lead to more successful outcomes generating better competition in the early phases.

Finally, the Geospatial Commission should work with stakeholders, especially the UK Space Agency, to ensure that the UK benefits from its significant investment in the EU Copernicus programme, as well as future evolutions/expansion. The loss of industrial access to Copernicus and preferential access to its data could be devastating for the UK's Earth Observation capability.

Stimulating demand by encouraging take-up

Government is in a unique position to act as a convenor, for example in the role provided by the Knowledge Exchange Network (KTN). As part of the *Prosperity from Space* strategy the space sector has proposed to work in partnership with the government on cross-sector opportunities. Initial engagements were held with representatives from the rail, agri-tech, marine, and defence sector deal teams where it was indicated that space, and EO in particular, could drive innovation and increase productivity across many industrial sectors. We encourage the Government to drive forward on cross-sector Earth Observation (and GIS) initiatives as part of a *Space Sector Deal*.

Q7: Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are three types of growth that should be considered:

1. The geospatial industry itself: surveyors etc. These are providing geospatial data and services.
2. Geospatial driven businesses – i.e. those which are directly using and aware of. These would be oil and gas companies, for example, using geospatial data for exploration and managing their data to day operations.

3. Non-Geospatial businesses – i.e. those using geospatial data for their businesses – for example conveyancers using land registry data for house moves, taxi drivers using Google maps etc.

The greatest return to the UK will come from the 3rd category as this group is either not regularly or effectively using geospatial data (often because it is too hard to access, or not good enough), so the growth is because the data is easier to access and better/more useful, and then growth from incremental uptake of data enabling better decision making processes, for example a higher fidelity map enables fewer mistakes to be made. Therefore, the most important technologies are to enable the easier use of geospatial data by a generalist audience as well as broaden its applicability. This is echoed by the European Geospatial Business Outlook 2018[7] which highlights 'Big Data' as the most disruptive technology for the geospatial industry (along with IoT and Automation) because it allows geospatial to become embedded in the future economy. We believe that the key technologies are therefore:

- **Fast data storage and access:** allow users to easily interact with large quantities of data without long network delays. This may be enabled by edge computing to reduce latency.
- **GIS visualization:** allowing non-specialists to explore data recognising that even something as simple as Google Earth is too complex for many people. AR will have a role to play here and gaming interfaces (which millions of teenagers are already familiar with) may also become important.
- **Natural language tools:** allowing users to navigate and explore data without specialist knowledge.
- **Introduction of fleet and crowd sourcing:** use of fleet sourcing (data gathered from public or private vehicle fleets using on-board sensors) or crowd sourcing could become a game changer for data acquisition or…
- **Change detection:** instead of mechanically re-surveying with a fixed frequency crowd/fleet sourced data and satellite data can be mined to identify where changes have occurred and how. This can then be used to trigger other processes such as flagging for further investigation or surveying. This would allow a higher data quality, better freshness, and lower costs (by only checking the changes).
- **Digital Twins:** these can be used by both public and private sector organizations to better manage and optimise workflows. This needs core technology but also standards to enable it all to work seamlessly together across multiple organizations (and reduce the probability of vendor lock in).
- **Internet-of-Things sensor networks** could be critical for enabling dynamic digital twins.
- **Building Information Modelling:** allows the ability to make decisions at building level (as opposed to street level).
- **Predictive analytics, including human behaviour analysis:** this includes the fact that web advertising agencies now have access to huge amounts of data correlating behaviour with location. This could become particularly important in the defence and security domains.

Q8: How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data will be at the core of all future technology such as autonomous cars, 5G, clean energy, and augmented reality. For example, nearly every industry now uses SatNav / GNSS in some part of their value chain (even taxi-cabs, where the availability geospatial data is what enables Uber to disrupt traditional markets).

[7] European Geospatial Business Outlook 2018

5G is the obvious technology which will be deployed at scale in the next 5 years and requires good geo-spatial data because the high frequency (mm-wave) bands are strongly affected by buildings and street furniture. Accurate geospatial data could therefore be one of the keys to reducing the cost and schedule of 5G deployment in the UK (bringing forward and maximizing its economic benefit). Since multiple organizations will be performing surveys there is a case to be made for sharing the data, or at least standardizing the data exchange formats which has been identified as a major barrier to 5G deployment[8].

Looking forward autonomous vehicles will benefit from accurate surveys: although they will not be reliant on a 3D model they will be able to more quickly compare the environment to expectations. The same may be true for drone / unmanned aerial vehicles. In any case the availability of accurate and reliable PNT certainly is a critical need to open these markets and the government should take an active role to ensure that the required data is available free at the point of use. This includes traffic data (and V2X data for autonomous case) which might be used by companies to distort the market.

Building Information Management systems will become a very important technology in the future (coupled with IoT) since it will enable building owners (and government) to better optimize their efficiency and power usage.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public Sector Organizations could:

- **Lower the cost of data acquisition freeing up resources to invest:** by using satellite data or crowd/fleet sourced data with a change detection algorithm surveys need only be performed where changes have actually occurred. For example, local authority trucks could be fitted with cameras.
- **Lower the cost of maintaining the data and access:** by pooling data storage and access (i.e. through a cloud based approach) using a common geo-spatial platform.
- **Incentivizing the private sector to contribute data or by retaining ownership of data as part of contracts let by the public sector:** establishing common data standards to reduce the cost of transferring this data into the publicly owned data store. Another approach would be to allow qualified surveyors to directly update public databases as is done in other countries, like Canada.
- **Examine agile (spiral development approaches) to data management** with a continual refresh cycle, learning from the software industry and cutting edge approaches such as SAFe[9].

There are opportunities to bring in new data sources (like satellites, drones, IoT, etc.) where the expertise lies in industry. It would not be efficient to build this capability within the PSOs as it would lead to duplication and competition for scarce expertise. Therefore, partnerships with industry, and co-investment models, will be the most effective approaches to enhancing the data sets.

A sensible approach seems to be that each organization is responsible for their own data (and hosting it), but that interoperability and standardization are baked in with a central organization which allows this data to be discovered, retrieved, queried, and processed (including fusion). This central facility could take some of the burden of maintaining the data set access.

[8] Lowering barriers to 5G deployment, Yardley et al., Report for the Broadband Stakeholder Group, July 2018

[9] SAFe, the Scaled Agile Framework

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

The Space based GNSS infrastructure we have today provisioned from US GPS, Galileo, Glonass and others creates a rich service. However, we will see evermore instances of spoofing and jamming as location becomes ever more valuable (e.g. Offender tracking) and mission critical (e.g. Autonomous CAV, GNSS driven rail signalling control). Creating infrastructure and services to defend against this threat both from criminals and terrorists should be a priority.

Indoor navigation is also an area with phenomenal potential; the European Geospatial Business Outlook forecasts that indoor navigation is the fastest growing business area at 39.9% CAGR[10]. From the delivery of location based commercial services / information to customers, identification and maintenance of assets both underground and in buildings, and improvement of location based services in other areas environments where space based GNSS is not effective (e.g. where multipath interference exists in urban canyons / underwater). Creating indoor/outdoor positioning standards and investing in infrastructure so users' location seamlessly transfers from outside to indoor will truly take the advances and services possible in industry and commerce to the next level.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As mentioned in Q9 the role of the private sector could be to:

- Drive the reduction in cost for maintenance
- Introduce new technologies for maintaining and accessing data sets
- Working in partnership to introduce new data sources using the expertise in industry, specifically around remote sensing/satellite EO, and IoT
- When government uses the private sector to store data with a geospatial component, ensure that it is available through a geospatial data infrastructure.
- Work in partnership with government to develop new data quality and interchange/interoperability standards.
- Contribute updates when suitably qualified as part of 'normal business', particularly when carrying out surveys.

Regarding infrastructure, the private sector would take on the responsibility of building infrastructure, using its proven expertise. Experience shows that joint investment models are difficult from a business case (e.g. the originally proposed PPP on Galileo) and therefore we think that public procurement is the best approach for public infrastructure. However, there is a role for the private sector to help the government be an intelligent and effective customer.

Q12: Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

[10] European Geospatial Business Outlook 2018

Yes, we do face challenges: availability is not enough. For example, a large number of data sets are available on data.gov.uk (many containing geospatial data) which are difficult to discover, query and process (and the underlying quality is difficult to assess). This has been recognized, for example, in the roll out of 5G[8] where data exchange between the private sector and government was highlighted as a key barrier to overcome (particularly that data requests can take a long time to be met).

Remedies should include:

- Introduce a simplified geospatial platform to discover publically available geospatial data and provide it in a pre-processed (analysis ready) way. For example, by making structured location based queries returning only relevant records in a certain locale.
- Provide Analysis Ready Data (ARD) ready for users / developers to integrate into their solutions.
- Develop a common and simplified approach to licensing.
- Provide clarity and certainty on data quality, availability and freshness making it easier for the private sector to invest in solutions knowing that the underlying data will be available in the future.

Some geospatial data is huge (earth observation, for example) so there is a real need to look at the data access infrastructure: it's not easy to transfer Pb volume of data… This data therefore needs to be available in a bulk pre-processed format (so that the raw data is not needed) or provision is made to enable users to run their workflows on the same platform.

There is much evidence around the value of open data in the literature, much of it around geospatial data, for example Houghton 2011[11] studied the cost/benefit of Australian open data including GeoScience Australia. Beagrie and Houghton(2014[12]) also describe qualitative and quantitative benefits of data sharing and curation through research data centres showing a positive return on investment.

Q13: How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Pool requirements and purchasing (acquire once, use many times enabled by a joined up IT infrastructure).
- Engage with industry providing a focal point for exchanging problems and solutions.
- Develop a Geospatial Innovation Programme.
- Act a common procurement entity.
- Develop common standards (this can help export).
- Give a clearer sense of strategy to industry to help it develop the next generation of tools.
- Help companies sell geospatial solutions overseas by developing the relationship through the Department of International Trade and the international programmes of UKRI.

Q14: Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having

[11] https://www.ands.org.au/__data/assets/pdf_file/0004/394285/houghton-cost-benefit-study.pdf
[12] The Value and Impact of Data Sharing and Curation, http://repository.jisc.ac.uk/5568/1/iDF308_-_Digital_Infrastructure_Directions_Report%2C_Jan14_v1-04.pdf

access to, that might have novel and valuable use cases? What would that access look like?

- Regular / fresh EO imagery including VHR and 1m class SAR coverage of the UK (can use used for change detection)
- Adequate access to Copernicus data needs to be secured post-Brexit.
- Non-classified imagery acquired by the MOD shared across government.

This could be made available through the geospatial platform discussed above as part of the 'discovery' element of the Geospatial Innovation Programme.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

Industry has a clear interest in a straightforward approach which does not introduce new barriers. The strategy should be like a framework enabling, for example, city level adaptations. Where are local councils in the GC, for example? Their data is likely to be highly useful and valuable. GC should help local bodies to use their data to build the local economies. Common platforms and standards would help here. Given the fragmented nature of geospatial purchasing providing an easier entry point for industry would be very useful to help spur innovation.

Q16: How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

Develop a strategic framework, common standards, provide training, and low cost software tools/platforms provided centrally. Make it easier for local authorities to do their jobs and they will take up the best practice.

As part of the Geospatial Innovation Programme develop the catalogue phase to understand what is available and include data quality/discoverability.

Establish a Special Interest Group (SIG) through the Knowledge Transfer Network (KTN).

Share information through conferences / working group such as GeoBusiness, BIM Alliance, British Association for Remote Sensing (BARC).

Q17: As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified:

• property and land

• infrastructure and construction

• mobility

• natural resources

• sales and marketing

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

As the 5th largest IT services company in the world we operate across a broad range of industries, including:

- Communications

- Financial Services (including banking, financial markets, and insurance)
- Government (including local government, secure cloud, law enforcement and justice)
- Health
- Manufacturing (including aerospace and automotive)
- Oil and Gas
- Retail and consumer services
- Space and Defence
- Transportation and logistics (including aviation, highways, intelligent transport, rail, post)
- Utilities

Therefore, we have a broad view on the usefulness of difference geospatial technologies and applications. We often incorporate geospatial technologies in wider solutions.

A potential infrastructure application is planning for radio network deployment, particularly around the 5G roll-out[13]. This will be one of the largest infrastructure upgrades in the UK over the coming years with a critical geospatial component. We have interest from local authorities and companies (this needs to be commercial in confidence). Access to high quality geospatial data is a critical component as the high frequencies of 5G will mean that effective network design needs to take into account buildings. Plus, local authorities are looking at using public sites for base stations. CGI are working on this tool which we believe could have a major benefit by reducing deployment costs which accelerating the roll-out speed.

Other infrastructure identified as key for the UK include smart cities, including smart building management. These will be enabled by BIM and IoT.

The Geospatial Commission should look at the Thematic Exploitation Platforms (TEPs) funded by the European Space Agency. These are tailored platforms for particular user communities. CGI is involved in the Forestry TEP and the Food Security TEP. It is also part of the “Expand Demand” project for Oil and Gas. These provide valuable reference points to drive into new markets and verticals. With additional geo-spatial data sourced from the UK they could become more and more useful by using not just satellite sourced earth observation data.

Q18: Are there any other areas that we should look at as a priority?

In our response we consider that the communication domain is covered by infrastructure (and note that future mobility also depends heavily on communications). Do communications need to be listed separately?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

As mentioned above we see 5G as the case where geospatial data will be used in a major national roll-out in the coming years and where the ambition of being a world leader is shared between the Geospatial Commission and DCMS. The challenge here is multifaceted as it includes also spectrum allocation which also has a geospatial character (for example in the licensing of transmitters).

[13] Connected Future Report, National Infrastructure Commission, Dec 2016

Augmented reality will become increasingly important for access to geospatial data in the future, for all industries. Instead of having to interpret an out-of-date paper map, contractors will be able to use their AR enabled smart-phones to 'see' the pipes under the road in real-time. This is already happening: we have a project in Kiruna, Sweden using GIS and AR to visualize the 'hidden city'[14] offering huge potential for increasing the speed and accuracy of city maintenance in the future.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

GC is a good start but there have been past initiatives; this needs to deliver. It must go beyond and embrace new technologies and data sources to be seen as innovative. Opening OS master map is good, but very localized and not exportable (with licensing / ownership issues).

For the UK to become a world leader it needs to develop scalable ideas which industry can take globally. The UK, with its unique position, offers a complex but highly visible shop-window. Through the Geospatial Commission, the proposed Geospatial Innovation Programme, and online portal(s) can become a showcase for British technology.

We recommend that the Geospatial Commission also engages with the Department of International Trade (DIT).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The UK is a world leader, but it is not alone. OS has a number of good cases studies which should provide an easily accessible resource for the Geospatial Commission[15].

The US has extensive policies on geospatial data, including the geospatial platform (https://www.geoplatform.gov/) which is:

- A one-stop shop that delivers trusted, consistent data and services
- Authoritative data to support informed decision making
- Reusable applications and services for governmental and nongovernmental use
- A shared infrastructure that can host your data and applications
- A focal point where governmental, academic, private, and public data can be visualized together to inform national and regional issues

It also has a clear "National Plan for Civil Earth Observation" which includes an in-depth analysis of which data sources are used and how (note that the highest priority "Earth Information" system is GPS). It has the extensive Landsat programme.

Canada – has a federal geospatial platform including "Open Maps" which is a route to find and collaborate using the Canadian government's inventory of geospatial data. https://www.nrcan.gc.ca/earth-sciences/geomatics/canadas-spatial-data-infrastructure/geospatial-communities/federal

[14] https://www.cgi.com/en/case-studies/kiruna-sweden-augmented-reality-smart-future-city
[15] https://www.ordnancesurvey.co.uk/international/case-studies/index.html

The EU is rapidly developing the Copernicus programme which increasingly encompasses non-space elements through the applications development programmes (often via ESA). The UK needs to remain part of this programme since it is not practical for the UK to replicate this capability.

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Channel Coastal Observatory
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

While the view of geospatial data seems representative, I note that there is no mention of temporal – it is often key that geospatial data is shown with accompanying timestamps, in particular if predictions or hindcasts are to be made using the data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Assessments of the errors and uncertainties associated with geospatial dataset and it's application. This is something often overlooked, and I often come across individuals who have undergone training (GIS) for example, who then become over-confident in the methods, and apply it inappropriately .

Importance of thorough validation and ground-truthing of much of the data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In general, the needs of our organization are met well through current university training programmes. In general terms this is familiarity with geospatial data collection tecnhiques (TRK GPS, Laser Scanning, Lidar, Hydrographic Survey, Aerial photograpgy) and use of GIS to analyse this data – at a post-graduate level these are well addressed.

Promotion of careers in the sector should emphasise the great diversity of careers that use and rely on this data, and the bredth of possible jobs that could be achieved.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

I am director of the Channel Coastal Observatory, which is part of the National Network of Regional Coastal Monitoring Programmes. We collect and disseminate geospatial data related to the coasts under Open Government Licesnse through our website https://www.channelcoast.org/ to support flood and coastal erosion risk management.

As our data is used to inform coastal management decisions, it is necessary for us to understand how coastal defence assets are managed. As such, it would be useful if access to the Environmental Agency AIMS asset database was easier. One problem that has arisen here, is memebers adding data to this database, only to be refused access to their own data at a later date.The inefficiency that has been involved with trying to regain access to this data has been considerable.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The emerging technologies are tending to produce much larger datasets, requiring more processing power and skills to handle as a user. Guidelines will need to be provided as to the specification of this data (plus likely errors and confidence limits), and what it can and can't be used for, as well as the best way to interrogate it.

Decisions need to be made as whether to provide access raw data, subsets of processed data or both.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Free access to geospatial data is key to ensure it's use, as is developing easy ways to download and understand the data. A range of products should be available for each dataset, which might include raw data, key parameters of importance, or prepared maps.

Online viewers and data manipulators which allow people with less skill in analysis software to still view the data collected would also help uptake.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Unmanned aerial vehicles are going to become widely used in the future.

We have seen a lot of growth in interest on High Frequency Radar instalations to provide geospatial data of hydrodynamic conditions, but datasets are large and analysis difficult.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Through full assessments of the suitability of these new technologies, and careful cross-calibration and comparison to the standard established methodologies. This should include cost-benefit analysis. This will increase trust and uptake of the newer technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Investment in the appropriate infrastructure (databases and storage) and skilled users, as well as promotion of use of the data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Increased networks of (maintained) GPS control points would allow others to georectify their own data into the national databases with less investment.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

It should depend on both the cost-effectiveness and longevity of this approach. I.e. will private sector developed infrastructure be supported in the longer term? Is it more cost effective/efficient?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Access to some databases is extremely difficult, even to our own data, and even when permissions have been granted at higher levels within organisations.
I think one of the problems here is in failure to keep the data infrastructure up to date, and databases falling into out-of-date or sporadicly updated status. There needs to be investment beyond the establishement of databases, and through to their maintenance (and migration if necessary where technologies change).

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By full consultation of what the public sector needs from the data, and establishment of standards based on that. Consultation is often ineffective, because people don't find out about it until it is too late to feed into the process.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

One of the barriers that the channel coastal observatory has faced when trying to integrate with other national bodies, is retaining the necessary information regarding who going on to use the data.
We have a requirement to justify continued investment into the monitoring progeamme, and part of this is that we need to link the use of our data to flood and coastal erosion schemes and projects – which we do using download logs and metrics. The loss of this functionality, which would occur if we made our data available through a single UK portal, would make this impossible and risk the loss of the programme.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

By ensuring that the right people are involved. The LA system is complex, and reporting structures sometimes mean that the right people aren't always involved/consulted in decision making.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Heritage management could be another area with great social benefit – identifying areas at risk for example.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By having well defined standards, and examples of best practice. By leading the way in innovation and R&D. By involvement in international forums.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:
geospatialcommission@cabinetoffice.gov.uk.
Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Chartered Institution of Civil Engineering Surveyors (ICES)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Professional body

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We would add standards and regulation:

- Determine appropriate standards, by first investigating existing and future uses, accuracy requirements and the metadata needed to make the dataset fit for the intended purposes.
- Introduce and mandate regulation, to achieve consistency, reliability, interoperability and currency of data through discussion principally with the two qualifying bodies, the Royal Institution of Chartered Surveyors (RICS) and Chartered Institution of Civil Engineering Surveyors (ICES), and with involvement of other partners such as The Survey Association (TSA), Association for Geographic Information (AGI) and Institution of Civil Engineers (ICE).

The view in terms of the functional naming of categories is fair.

Within each category there are subsets of data that may be 'open data' and some of that is available under commercial license. Determining what is accessible as open data and the policies around that would benefit users.

Definitions
Geospatial data: Change 'place' to 'location'. *Information where location is a key feature of its source and/or purpose for which it is used.*

Positional data: 'Positional' data does not make sense, it should be 'locational'

data. Positional implies that it is being positioned, but the description is of location information. We call this ‘attribute data’ in the survey world.

Geospatial identifiers: Is this going to include data for how current the knowledge is?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Education

In broad terms, the UK pipeline for geospatial talent is under threat. The number of college and further education institutions supplying geographic information systems (GIS) and geospatial training for foundation land surveying/geospatial engineering are limited due to demand.

Including GIS in a more accessible part of the secondary school curriculum should be encouraged. This has been facilitated by provision of subsidised GIS resources by GIS4Schools and Esri under the provision of the general geography syllabus at KS3 and KS4. The assumption is that by exposing more school age children to GIS, it will precipitate a greater awareness in later years, creating more demand five or six years down the line at the point where GIS specific/complementary roles at college or university will be in increased demand. Whether academia in partnership with UK industry sustains that uptake is uncertain. Data on degree type placements/apprenticeships in projected years is unavailable.

Combining aspects of maths education with geospatial intelligence would increase awareness and propensity for development further. Several countries in Africa have made GIS part of the mainstream education to educate whole generations.

The profile of surveying needs to be raised as a career that embraces the collection, processing, handling and presentation of geospatial data and metadata.

The new Geospatial Survey Technician (level 3) and Geospatial Mapping and Science (level 6, degree) apprenticeships should be encouraged.

Skills

The global outlook is that in the longer term, routine desktop GIS is being deskilled, as the functional capabilities of web platforms that provide analysis become increasingly available. As geo-information becomes easier to use, it means the specialists move to another place in the market. The skill lies in delivering the product to market and collecting the source data (developing new data), rather than the traditional GIS role of prepping data and conducting analysis and presenting it visually. Surveyors will also become managers of devices and strategy in harvesting more and more data remotely. Strategies to deliver swathes of data (light detection and ranging (LiDAR), for example) with semi-automatic

processing will become the norm, rather than individuals collecting data through 'contact' surveying and physical measurement.

Industry

The Institution of Civil Engineers' much-lauded Project 13 business model does not feature geospatial within the digitalisation table. If this model is to be promoted by government, the role of geospatial data needs to be included. The industry needs to understand that alliance of skills also means alliance of data. When data is working in an alliance (interoperability) there is operational excellence and efficiency.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Geospatial skill gaps exist in some public intelligence units because public sector pay currently does not match that in the private sector.

The 'intelligence community' hierarchy of many employers places GIS and geospatial competence beneath other disciplines such as statistical analysis and SQL programming. Organisations do not promote major structural changes in the way tasks are executed, that could be beneficial, because GIS is not seen as a primary tool to solve a lot of issues. There is a dependence on older statistical solutions and traditional database structures.

Clients do not know what data to collect and retain (we have gone from clip board to iPad in under 20 years), this means that UK plc is working in different directions. Employer information requirements (EIR) should be part of the project start-up and include specific geospatial data capture requirements. Building information modelling (BIM) execution plans and contract structures that specify spatial data exchanges and frequency succinctly can remedy some of this if processes and data needs are able to be identified in a timely fashion.

The military plays a large part in the capture and reuse of data. Today's servicemen and women are tomorrow's civilians and their mapping skills will be useful. The private sector should be made more aware of schemes that find employment for former members of the armed forces.

Teachers and careers advisors do not know what careers opportunities exist. Newcastle University is currently looking for funding to revive its Geomatics.org initiative, which was set up to promote geospatial activities in schools, develop project resources and outreach. A central careers hub is needed online and this could become that solution.

Partnerships between software and technology firms, such as Bentley Systems, Autodesk and Topcon with the Class of Your Own 'Design Engineer Construct!' school curriculum, and Leica Geosystems with the Constructionarium site learning

project for university students, should be encouraged. For example, Bentley Systems is sponsoring a project with Class of Your Own for pupils at four UK schools to design a hyperloop link between Singapore and Kuala Lumpur. This shows the exciting future prospects a career in geospatial technology can bring.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

With regards to land ownership and conveyancing – it appears the greatest purchase you make in your life is in the hands of people who do not understand geospatial data. Lost or unregistered land would become a thing of the past if surveyors measured the footprint of what was going to be conveyed. Conveyancing surveys that would measure geospatial location and attribute data would serve the housing market and land registry. This would assist planning authorities and utility companies in their service proposals. However, the data has to be captured on the correct grid.

The adherence to OSGB36 as the national reference framework, and on which so much legacy data is based, has been out of date for 30 years or more. OSGB36 has errors ranging up to the tens of metres in the Scottish islands. Since 1984 (WGS84), with the advance of satellite technology, we have developed time stamped international reference frameworks at the centimetre accuracy level. It is time we adopted such a reference framework and reverse engineered OSTN15 to convert the legacy data to the adopted system.

The absence of a common data portal is the biggest problem with many government agencies. In some cases it could be that a portal does exist, but communication regarding its existence may be limited. Highways England, at a national level, is supplied with a driven LiDAR dataset of its estate. The regional part of the dataset is procured from a contractor (IBI Group) and the data is sent by post as there is not a government portal available that both uses the cloud and can support file transport. The Environment Agency regularly uses Amazon cloud services to host data.

With regards to Earth observation data, the UK has access to 10m resolution satellite data from the Copernicus satellites and European data portal. At an intermediate level, the data is useful for some planning decisions. However, at ‘site’ level, 1 to 3m and 5m resolution is necessary for land cover classification and to support environmental management inspections (reducing manual inspections and adding consistency). This should be available nationally.

Underground utility information is not sufficiently ‘open’ and connected. However, there is commercial interest in this data that requires pay-per-use to enable it to be open. This should be nationally available data, with the correct security levels.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

what3words is a fine example of making location data easy to use, however it does not consider height but it is suitable where there is not existing infrastructure, initially.

Postal addressing in high raised apartment blocks is not linked to the actual height of a building and with the opportunity of drones delivering to the right address, the altitude in an address would enable the safer delivery of parcels, and in the case of emergency drones a faster response. For example, if Flat 6 on Floor 3 was addressed as 'Flat 6, Floor 18m' you would have more useful data just by changing the addressing system.

Hosting volumes of data and communicating large datasets across government departments and with the supply chain is challenging. There are difficulties swapping data across government departments such as the Land Registry. Homes England seems to be much further ahead with respect to GIS technology, doing a role similar to the estates and property teams in Highways England.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Remote sensing/Earth observation is a niche area but its reach is potentially very large. Unlike more conventional geospatial data, its use is not widely appreciated and few people are attracted to this area of work because of this. The subject has to be more widely communicated, so that staff can be attracted to the arena and products can continue to be developed. To stimulate growth, more research has to be funded in commercial and joint projects that involve academia, the private sector and government.

There should be investment in state-of-the-art imagery for the UK and its territories as a minimum, and internationally to open up the UK to potential new markets. Bespoke detection algorithms can be used to extract features, store data and retrieve suitable data for potential markets. This could be sold as a UK digital service. For example, the construction, surveying and planning sectors could use this data to better evaluate concept design, survey, construction progress and the maintained asset.

Finding programming talent and people with skills is difficult. These specialisations do not attract 'template' employees and talent needs to be grown through investment and sponsorship. Within government, increasing partnerships between agencies and offering opportunities to host 'hackathons' and share technical skills and knowledge through shadowing and exchange/secondment opportunities would help reinforce the skills base.

The Earth Observations Centre of Excellence is a community of specialists in the field, who are based across several DEFRA and other agency departments. This 'hub' of talent seems to be weighted heavily within DEFRA (to the possible exclusion of other organisations, such as those under the DfT umbrella that have stronger ties to infrastructure).

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission should focus applying what is good in one area and rolling it out nationally, be it technology types, services or standards.

Primarily, sectors requiring navigation for autonomous movements such as cars, aircraft, unmanned aerial systems (UAS or drones), railways, shipping and construction machine control. Secondary, all sectors involved in asset and facilities management.

The FixMyStreet app that reports issues to local government shows a good response time in some areas, however people are not widely aware of its use. If used to its full capability, this would provide a real measure of what is reported, where, why and when it was resolved, and enable national operational efficiency.

The global enfranchisement of geospatial data as a commodity has been made possible because of communications technology and miniaturisation of electronics, but more significantly because of artificial intelligence (AI) by the market leaders. Crowd sourced data is increasingly useful as devices become increasingly accurate and integrated into networks with corrective and redundancy processing. It seems that commercial organisations will become increasingly agile and successful in becoming the most efficient suppliers of terrestrial data. Traditional government agencies will lose work to commercial market operators at this time. Investment in education rather than competing in overtly commercial enterprise would seem to be a sensible route. Controlling commerce by licensing certain technology and 'rights' and enhancing national strategies by developing data standards that support a certain technology standpoint or facility are tools to motivate the home market.

Domestic policy regarding drones and aerial data acquisition has key impacts on terrestrial survey. There is a technology race between the capabilities of semi-autonomous drones (perhaps operated as fleets) and high resolution low orbit remote sensing satellites. The AI programming necessary to get intelligence from both types of data can be procured from third parties or can be home grown. Location intelligence in all electronic devices seems to be the inevitable end result.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data can improve processes for construction and maintenance of our assets, environment and ecology. The BIM process supports use, re-use and renewal of geospatial data through the lifetime of an asset. However accuracy is essential for the BIM process to succeed.

Asset geo-tracking of all publically financed vehicles, trains, buses, council vehicles etc would provide live accurate data on the performance of transportation times.

Smart street maps will support improved urban navigation for autonomous vehicles.

Autonomous vehicles will rely on accurately mapped infrastructure to help determine their own positions. For example, knowing the exact geospatial position of a bridge pier will help the vehicle 'know' its own position in relation to that fixed point.

Geospatially enabled data offers instant automated decision making. We see this already in many apps, such as warnings in sat navs about speed cameras and speed limits. Accident blackspots can be recorded and assist the travelling public.

In the initial analysis document, geospatial data linked to sales and marketing is mentioned, this same approach could be used for public notices and information. Geospatial data would be a useful determiner to see if advertising distractions are linked to accident black spots. Quick response (QR) codes and image recognition in adverts and information posters can capture the best locations to advertise.

Internal mapping of public buildings will ensure that people are able to find the location they require more easily.

If enhanced roll-out implies 'wide coverage' and uptake, then partnering with social media would seem to be a necessary vehicle.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector clients see data capture as a cost, this is a very short term view. Data capture should look beyond the current client. Legacy data can be of use to many other clients.

If the model that the energy market uses is anything to go by (until recent legislation was enacted), independent suppliers that satisfy the standard can contribute to 'the grid'. On an inter-agency level, agencies should pool resources and supplement each other's data under a universal memorandum of

understanding.

Contemporary commercial location services providers are using ‘electronic tokens’ in autonomous data exchanges, where each piece of data has a value that aggregates to rights to use the larger datasets. This can involve:

- Pay-per-use for advanced level data or exchange data credit for credit.
- Corporate customers support data that they use and return the data updated.

This ensures data is of sufficient quality to be able to charge for it. It drives the adoption of commonality of feature coding, metadata and data structure for interoperability between users. Also, continued investment will result in reduced costs for the public sector.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS (American satellites only) is not the correct term. GNSS (Global Navigation Satellite System) is the correct term that covers all systems, including Russia (GLONASS), America (GPS), Europe (Galileo) and China (BeiDou).

The UK is invested, at national policy level, in the cross-European Galileo GNSS programme. It is through joint membership of the European Union and in partnership with the European Space Agency that it augments its involvement. Future access to the channels of both GPS and Earth observation data provided by Galileo and other ESA operated systems may be at risk through Brexit. Looking at the resilience of existing systems, as well as continuing to develop new and improved methods, is vitally important.

As stated in our response to Q4. We need to adopt a single reference framework based on current technology with the ability to upgrade accuracy in future. Since 1984 (WGS84), with the advance of satellite technology, we have developed time stamped international reference frameworks at the centimetre accuracy level. It is time we adopted such a reference framework and reverse engineered OSTN15 to convert the legacy data to the adopted system.

The UK should be developing positioning technology (including indoor) to assist movement of all types, autonomous and manual. This means finding methods for hybrid outdoor/indoor positioning that can be used by both people and machines.

Indoor navigation using simultaneous localisation and mapping (SLAM) technology should be promoted and what it requires in order to work effectivey should be understood. SLAM relies on precise background mapping at centimetre

level or better – this needs to have high relative and absolute positional accuracy for local navigation and journey support.

The long range wide area network (LoRaWAN) specification is designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks. This new method of communicating should be part of the digital infrastructure or recognised as an enabler within the strategy.

Crowd sourced data collection should be high on the agenda.

We need a consistent naming convention to aid reference without technology. The linear referencing system used along our infrastructure (marker posts) does not have a linear reference that could apply to other assets along that route. Simple naming convention changes to use a linear reference system, backed up with a geospatial position, would help the building and maintenance of those infrastructure routes. For example, on the M1 motorway, the lampposts will be numbered 1/2/3/4 north or south bound. However the French toll road method would name them at linear distance along the route: 50/100/150/200. You can now see the lampposts are 50m apart and the distance along the route. If all street furniture was labelled in this manner, it would aid the travelling public, the maintainer and the emergency services.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Professional membership bodies and the private sector already work together through the Survey Liaison Group to write client guides and best practice. The Survey Liaison Group comprises the Chartered Institution of Civil Engineering Surveyors (ICES), Royal Institution of Chartered Surveyors (RICS) and The Survey Asociation (TSA). Members of these bodies work for both public and private sectors and it is fundamental that they continue to innovate, propose and write best practice through their professional bodies in this way.

Private sector companies are innovators and quicker on their feet in adopting and developing new technologies. They and the professional governing bodies (RICS and ICES) should have a major role in the government's Geospatial Strategy. If this strategy requires a standalone public body, then they should have representation on the board.

The private sector will always be more agile than the public sector. However, if the public sector continues to be seen as the client of private sector enterprise, then it has to be more effective in leading in the partnership. Client-led projects are the way to move forward from proprietary systems and formats and to continue to make data methods and products 'open' where desirable. Freeing up spatial data can only happen if there is a good balance and clear governance in implementing a longer term spatial strategy. Collectively, supplier frameworks where data services are provided cooperatively are less onerous than single contractor

frameworks.

As mentioned in Q6, the products and technologies available through Earth observation are not self-evident and the marketplace needs to be stimulated and grown through a variety of initiatives. The defence industry can play a large part in the acquisition and resale of geospatial data.

The roles of the private sector and government clients alongside a desire to free-up spatial data for the public good is a complicated balancing act, but the government has leverage through licensing in the communications and aeronautical/space sectors. Identifying and supplementing sectoral funding and expertise where it may be in deficit after Brexit will be an important task. Already the European Space Agency (ESA) has relocated one of its operations hubs from the UK to France and in a highly specialised niche industry this will have an impact in related business. The private sector needs to fill the gap where the UK, as part of the collective EU/ESA enterprise, formerly benefitted and continue to develop initiatives that could be stifled.

The private sector has a role to play in confirming data collected through crowd sourcing.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Business will find the best use of data to drive efficiency, however common formats or national standards do not exist. The National Geospatial Strategy should ensure that geodata specialists have experience in all sectors to understand the interoperability needs and the forming of standards. The Geospatial Commission should be more parental and insist on standards linked to naming and coding. It should insist on interoperability between all software vendors and remove the .dwg/dgn blocker that is genenerated by software houses, such as Autodesk and Bentley Systems, and can cause a loss of data when converted.

Open data formats are not completely open, nor support seamless data transfer. Technical teams (in highways and construction) largely expect data in CAD format, but the default GIS option in most government spatial exchanges is the shapefile. The Open Geospatial Consortium (OGC) has sanctioned GeoPackage as the replacement format to shapefile. However, ArcGIS online appears to be the preferred platform under the DfT/Highways England. This, together with ArcGIS Pro, is incompatible with the ‘open’ format of GeoPackage. It seems that at least two GIS platforms are always required to deliver work for internal clients. Survey4BIM is currently researching this area of interoperability.

Interoperability is the first hurdle. If that can be overcome then accuracy, content and currency rank second, third and fourth. Interoperability can be overcome if the software houses agree to collaborate. Accuracy, content and currency can be solved with attributes added to the dataset.

Highways England uses a mapping system that differs from Network Rail for engineering reasons (due to local grids). However, now the population interacting with those maps has grown to such a size that engineering reasons may be better solved locally, rather than over the project length. The majority of mobile device technologies do not unlock their potential due to local grids.

The Geospatial Commission should call on clients to make adoption of the PAS 128 and 256 standards compulsory in underground utility location recording.

The funding of BSI geospatial standards, such as PAS 128 and 256, should come from government instead of private industry. This would help the perception of these as national standards.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission (in line with its operating principle 2:2.1g) should fund a project to deliver a Topographic National Feature Code Library. This would be hosted by Ordnance Survey. Survey instrument manufacturers and software houses would adopt this as a national standard. This would mean that when geospatial data is collected via a survey device, it would be in the right format from the first opportunity, ensuring ease of interoperability.

Organisations like the Assocation for Geographic Information (AGI), Chartered Institution of Civil Engineering Surveyors (ICES), Royal Institution of Chartered Surveyors (RICS) and Institution of Civil Engineers (ICE) exist to increase the competency of their members. They can mobilise them collectively for training, workshops and conferences in a way that their government employers cannot do. The Geospatial Commission needs to work with these organisations, at a regional and national level, to ensure public sector staff have access to this.

The geospatial requirements of central and local government need to be established. As do the needs of industry.

The public sector needs to be made aware of the value of space and time. Data in a database does not always have the naming and location specific to a national standard. Data must be tagged with location (space/coordinates) and the currency (date/time). For example, this event happened here at this time. This has a great value that is not always understood.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As mentioned in Q4, government agency staff are already using Amazon cloud services to host explicit and less explicit data, in the absence of a more tailored mechanism.

There are many geological and ecological data sets of varying degrees of accuracy and levels of detail that all relate to geospatial datasets. Using a geospatial reference point to access a layered structure of the different data sets available would be extremely useful. For example, Excel spreadsheets of data of pollution events may refer to the distance polluted on a river without this being mapped. The use of mapping data sets, rather than tabulated data sets, would be beneficial.

The Environment Agency used to run a 'what is in your backyard' service with information on pollution incidents. This has been replaced with a system that members of the public may struggle to understand. It would be useful to see environmental incidents in a geospatial layer similar to the way the EA displays flood risk on the same website. A map version is always more user friendly than XML.

Data handed-over following the completion of successful construction projects would be extremely useful and beneficial for future projects – especially for work from the public purse. However this is often contractually unavailable.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

There should be a standardised national approach to geospatial data.

Participation and sharing of UK-wide data should be mandatory. There should be regional representation on any board governing this. This would ensure policies would have a consensus from grassroots upwards.

All regional data, including from the devolved administrations, should be merged and compared for consistency. The UK data should build on that consistency. Regional variations should only be allowed to be appropriate to the mapping systems and grids.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Regional geospatial champions should be identified, who can liaise with local authorities, agencies and report back to the Geospatial Commission.

Local authorities should lead by example and embrace the Internet of Things, AI and geospatial telematics on local authority vehicles for example.

There should be an 'NHS-style' patient databse approach, where centrally held geospatial records can be accessed by local systems, with appropriate security and permissions filtered in.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

All transportation sectors – road, rail, air and sea – offer immediate benefits from increasing autonomous use.

The construction sector already uses 3D machine control. This could be made simpler and more accurate with the adoption of a national framework.

Incentives for improving the Land Registry dataset and land ownership records would be of big benefit. A self-registration scheme could exist where a drone operator could capture the property in the same way that home information packs were originally intended. Boundaries could be extracted digitally and compared to the digital record, then witnessed.

In the health sector, patient recovery times and if they recovered at home, hospital or other place could be mapped and inform best practice. Poor attendance at check-ups and appointments could be mapped and aid a targeted education roll out.

Q18: Are there any other areas that we should look at as a priority?

Standards or gaps in standards and where they align to the National Geospatial Strategy.

UAS (drones) are a sub category of the aerial sector and regulation and control needs to be addressed as a priority.

Impoved mobility for the disabled relies on location data and the AI/human interface being developed.

High precision mapping for autonomous vehicles.

Increased adoption of BIM in infrastructure and construction.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

All transportation sectors, road, rail, air and sea and the construction industry rely on geospatial data. Everything is serviced by location data, but clients need to understand what level of location information is required. Regulatory changes will be needed to control accuracy requirements and competency of the providers to meet those requirements.

Autonomous vehicles and fleets will be a concern. Highways England network managers will have to partner more effectively with road transport operators. At present, there is very little geospatial intelligence in roadside equipment. Harmonising the geospatial needs of the road operator with the road user will become increasingly important. Social media and the web are used to impart location information/status information between the two but the manual nature of this needs improving.

The use of ‘mixed reality’ data in construction and other industries will rely on geospatial data. There must be adherence to utility detection standards PAS 256/128 where appropriate.

Emergency service response with drones will require Civil Aviation Authority rules and regulations, and defined flight corridors. Autonomous fire engines will rely on accurate geospatial data.

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

Because of the collective and longstanding nature of the UK as a component in the EU and the European Space Agency, the UK will sustain some reputational damage through Brexit and will become diminished as a partner on the European scene.

The UK needs to make more visible its work in Earth Observation, surveillance, remote sensing capabilities in maritime, mining and natural resource exploitation arenas (regionally and globally).

Specifically, the Geospatial Commission should:

- Invest in and develop world leading systems, procedures, standards and regulations and market them.
- Ensure the UK is the first nation to have a national feature code library for surveying.
- Support an online hub for careers advice, see Newcastle University's Geomatics.org example in Q3.
- Use schools to host Geo-innovation hubs.
- Call for the removal of VAT on GIS software for the next 10 years, to encourage adoption.
- Increase training in GIS for Armed Forces reservists.
- Provide support for the emergency mapping charity Map Action, this could be linked to training provided to the armed forces.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

As mentioned in Q2, some countries have introduced GIS to the school syllabus Under programmes supported by Esri, for example, in Ghana, South Africa and Hawaii. The benefit will be that everyone from that generation will be GIS-literate. In the UK Esri has delivered GIS lessons to 60,000 children at KS3 and KS4, this has been supported by the Royal Geographic Society. The intiative also supports teachers through GEOMENTOR/find a teacher. This could be expanded within the UK to make GIS a key part of the curriculum as in other countries. It is noted that Esri is a US-based multinational company.

Ireland has adopted a new reference framework and made steps to update and streamline its cadastre, land use and rating as a consequence.

The majority of European countries have a coordinated cadastre. Germany's cadastral service is exemplary. Using accurate digital geospatial data would remove the reliance on 'opinion' from solicitors in land issues.

In Australia, survey data is held online and is much easier to access. In Victoria, a local authority team controls all as-built plans of contractors' road works, this will include legal property definitions done by licensed surveyors. It is based on a quite simple layer structure. Also, property surveys are loaded into a portal and attached to property via the Lassi Spear online system. This is a great way of using GIS data to overcome the problems of surveyors being unaware of previous works and has control loaded in. The UK is behind other countries when it comes to the rigorous application of coding of features when supplying survey data into the cadastral system.

Thank you for your time in completing your response to our call for evidence. Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	CLOSER, the home of longitudinal research
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	CLOSER, the home of longitudinal research, is an interdisciplinary partnership that brings together eight world-leading longitudinal studies with participants born throughout the 20th and 21st centuries, the British Library and the UK Data Service.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

- We find the distinction between geospatial and positional datasets a helpful one. We would like to flag the considerable analytic advantages that derive from being able to link geospatial data with positional data obtained from surveys. For example, small area geographical variables provide valuable contextual information that can be analysed alongside the rich and detailed information collected by the UK's longitudinal studies (including the birth cohort studies). Key sources of geospatial data include the Census, calculations of areal deprivation (such as Carstairs), ONS area classifications, air pollution and climatic data. In addition, researchers have used geospatial data to measure study participants' proximity to a wide variety of different facilities and amenities - including green space, types of retail outlet (e.g. fast food outlets) and public transport hubs. Further information can be found here: https://www.closer.ac.uk/research-fund-2/data-linkage/linkage-geographic-data/

- One challenge encountered by the longer running longitudinal studies relates to the paucity of geographic information available about the past,

which makes it difficult to add geographic contextual information to the early rounds of older studies. Even when such geospatial data exists, the process of correctly linking it to historical addresses is highly complex.

- In addition, linking study data to low level geospatial data requires careful attention to data access, as the combination of these forms of data makes study participants potentially identifiable. For this reason analysis of survey data linked to geospatial data typically takes place in secure locations such as the UK Data Service's Secure Lab.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

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Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Centre for Observation and Modelling of Earthquakes, Volcanoes and Tectonics (COMET)/Centre for Polar Observation and Modelling (CPOM)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Central government	
Charity or social enterprise	
Individual	
Legal representative	
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Other - please state	

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Centre for Observation and Modelling of Earthquakes, Volcanoes and Tectonics (COMET) and Centre for Polar Observation and Modelling (CPOM) are NERC centres of excellence that use Earth observation (EO) data to better understand geohazards (COMET) and the cryosphere (CPOM). In doing so we work closely with the national and international space agencies, as well as research institutions and other partners both in the UK and overseas.

Satellite measurements are fundamental to our work, and as a result this response focuses on challenges and opportunities relating to EO. Recent improvements in global EO capabilities, and the resulting growth in freely available data, have revolutionised our ability to monitor environmental change with increasing accuracy, and to model the physical mechanisms responsible. As a result, we strongly support recognition of the importance of EO in achieving the UK's geospatial goals.

The growth in EO data, particularly as a result of the Copernicus programme, also presents challenges. Much of this data still cannot be used easily outside of the sector, limiting the ability to deliver societal benefit. Both COMET and CPOM provide a number of EO data products and services, but there is enormous scope to develop further applications and we agree with the need to include geospatial

services and applications in any new strategy.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We support the development of geospatial skills and awareness across society. COMET and CPOM routinely deliver outreach and engagement activities, and agree that many resources and support mechanisms are already available which the UK can benefit from. We are currently working with the European Space Agency (ESA) outreach office, ESERO[1], and UK STEM to produce a national curriculum content on EO, relevant to a range of subjects. We anticipate that this approach will have a much broader impact than we could achieve alone.

Maximising the use of EO techniques will also require specific skills development and training. We have world-leading expertise in the use of Synthetic Aperture Radar Interferometry (InSAR) to monitor ground deformation for tectonics and volcanoes (COMET) and ice sheet flexure and ground line locations (CPOM). InSAR has potential in a broad range of geoscience and engineering contexts, however, its use remains limited outside of research. The Commission could therefore promote interest in and understanding of InSAR as a standard tool for surface deformation monitoring and risk mitigation.

More broadly, the UK needs to significantly expand its data processing and management capabilities. Skills in machine learning, blockchain, data mining and artificial intelligence will be important, alongside qualifications and career paths that make them an attractive prospect. General digital skills will also be important, with market evidence helping the Commission to focus on those sectors with most potential to exploit geospatial data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

CPOM and COMET employ highly skilled geospatial experts, but we recognise that increasing the skills base across society will help us to recruit and retain high quality staff, and to increase the broader application of our data and science. This will be particularly true when it comes to introducing new data processing and management techniques.

[1] https://www.esa.int/Education/Teachers_Corner/European_Space_Education_Resource_Office

We have recently joined the Copernicus Academy[2], which aims to bridge the gap between EO data and the skills needed to support uptake across new sectors. We anticipate that membership will help us to promote EO skills development more strategically, for example by signposting to existing online training provision and support services[3].

We also provide specific training opportunities: COMET routinely delivers courses aimed at postgraduate students and early career researchers wanting to integrate EO data, including InSAR[4], into their work. We have not specifically targeted non-academic participants, but, with the right support, the content could be adapted for the private and public sectors. CPOM has meanwhile contributed to Massive Open Online Courses (MOOCs) on monitoring climate and the polar ice sheets from space. Developed in partnership with ESA and FutureLearn[5], these have demonstrated how satellite EO provides insights which underpin scientific research, climate policy and public engagement. FutureLearn has already introduced a wide audience to geospatial data and its applications, and there is potential to develop and promote further online learning initiatives.

The Satellite Applications Catapult Knowledge Exchange (KE) Fellowship Programme[6] is meanwhile already connecting researchers with business need to fill organisational skills gaps. As a KE Fellow, CPOM researcher [Text redacted] is bringing EO expertise to the Sea Level Rise from Space project[7], which is generating a bespoke service to aid UK coastline management. Other projects include using big data to tackle environmental challenges, curating Earth observations of air quality for use by city planners, and using EO data for water quality monitoring.

We would also encourage the Commission to promote EO and geospatial data as UKRI training priorities, for example through creating a dedicated Centre for Doctoral Training (CDT). This would help to develop a skilled workforce whilst providing a focal point for end users to engage with researchers. As well as bringing together various geospatial disciplines and technologies, a CDT could also respond to user demand, focusing on the topics of most interest to the public and private sectors.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

[2] http://copernicus.eu/main/copernicus-academy
[3] http://copernicus.eu/news/want-learn-how-copernicus-fits-your-world
[4] http://comet.nerc.ac.uk/comet-insar-training-workshop-2018/
[5] https://www.futurelearn.com/courses/climate-from-space
[6] https://sa.catapult.org.uk/services/knowledge-exchange/
[7] https://spaceforsmartergovernment.uk/blog-monitoring-global-sea-level-rise-from-space/

COMET and CPOM are working to improve uptake of EO data by providing access to high quality processed datasets and products, primarily via the COMET LiCSAR[8] and CPOM Operational Monitoring[9] portals.

LiCSAR's automated processing turns InSAR data on ground deformation into products that are downloadable from an online portal, with the aim of encouraging more scientific applications as well as expanding the user base to new fields such as civil engineering, urban planning and hazard management.

The CPOM Operational Monitoring Portal meanwhile provides data products primarily on Arctic sea ice, the Greenland Ice Sheet, and the Arctic Ocean. The near real time measurements of Arctic sea ice thickness and volume, as well as floe distribution, are not only valuable records of climate change but also a resource for polar maritime services such as navigation, shipping, tourism and weather forecasting.

We are continually refining our services and products, and are keen to help end users to overcome any challenges to access and use, including any general points raised by this consultation. CPOM already inputs to the Copernicus Research and User Service[10], which provides a centralised support system for overcoming any barriers to using Copernicus data, and may be a useful model to follow.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

[8] http://comet.nerc.ac.uk/COMET-LiCS-portal/
[9] http://www.cpom.ucl.ac.uk/csopr/index.html
[10] https://rus-copernicus.eu/portal/

The vast volumes of EO data produced by the Copernicus programme, as well as the growth in satellite missions worldwide, will mean an increasing reliance on automated processing and machine learning, as well as taking advantage of developments in for example NewSpace and other technological transformations. We have already made significant progress in this area – as well as establishing automated processing via LiCSAR, COMET recently delivered the first use of machine learning to detect volcanic deformation in large data sets[11], demonstrating not only the potential for automated hazard alert systems based on satellite imagery, but also, potentially, a basis for other applications.

The Commission now needs to help IT companies traditionally outside the space domain to develop and implement similar capabilities so that they can access EO data and realise its commercial value. They should also support the new generation of data and digital entrepreneurs to realise the business opportunities. Again, numerous resources are already available. For example, the World Space Alliance is increasing the use of digital technologies and EO data in a range of business sectors by building the first business-ready spatial platform in the cloud, utilising existing big-data handling and dissemination capabilities. ESA is meanwhile developing its Open Science and FutureEO programmes to explore developments in the field, and publicise opportunities. We suggest the Commission learns from and integrates with existing programmes as appropriate.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Economic, scientific and societal benefits are possible through new spaceborne technologies, including cubesats and other nanosatellites, and hyperspectral and multispectral imaging missions, and the NewSpace agenda is evolving continuously. As above, AI, machine learning and blockchain will also be important for ensuring that data processing and management benefit from the latest digital technologies. In-situ technologies are also becoming increasingly sophisticated: the low-cost GNSS networks being developed by COMET[12] are aimed at geophysical or hazard monitoring systems, but other applications are possible.

Despite these developments, the need for larger, high-precision satellites will continue; there is still unrealised potential in combining measurements from large and small satellites to create integrated datasets; and we need to be better at using automated processes to extract information and intelligence from existing datasets.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

[11] https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2018JB015911

[12] http://comet.nerc.ac.uk/gnss-earth-observation/

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

COMET's GNSS networks, as mentioned above, have potential to measure ground displacements with sub-centimetre level precision at relatively low cost, and are energy efficient enough to log data continuously for several weeks if required. In the longer-term, we intend to develop a wireless network of GNSS sensors, each capable of transmitting raw measurement data, ultimately forming part of a real-time monitoring system. It is also envisaged that each unit will be capable of hosting multiple sensors. This approach has potential to be adapted to a range of contexts by the public and private sectors in response to data requirements.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We believe that interoperability remains a significant challenge for non-expert users of EO data, highlighting the need to reduce gaps between widely used geoscience dataset formats, and to help ensure that they can interact with each other smoothly regardless of origin. Both NASA and ESA have issued recommendations on interoperability, including on API accessibility and basic attributes, which should be considered.

We also suggest that the Commission consider the work of the Global Earth Observation System of Systems[13] (GEOSS), which aims to ensure that EO data is accessible, quality assured, and interoperable with a view to supporting the development of tools and services. Again, this includes promoting common technical standards so that data from different instruments can be combined into coherent data sets and analysis-ready data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

[13] http://www.earthobservations.org/geoss.php

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As well as accessing additional datasets, the Commission should consider the benefits of combining data from existing sources (e.g. satellites, airborne surveys and ground-based observations), as well as combining geospatial data with other types of data. This could provide more comprehensive and higher quality information, including analysis-ready data, to the public sector.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
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- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

COMET has already launched a spinout company, SatSense, which uses satellite data to detect subsidence. The SatSense algorithms extract usable and reliable measurements of ground motion from satellite radar images to precisely measure changes in ground movement as small as 1mm per year, helping to establish causes of subsidence such as tree roots, shallow landslides or groundwater extraction. SatSense results are more accurate than other systems currently on the market, and can provide information within hours instead of days or months. Potential users include home buyers, surveyors, mortgage lenders and insurers, as well as monitoring critical infrastructure. The SatSense approach may have other applications, and we would be pleased to discuss these with the Commission.

CPOM's near-real time measurements of Arctic sea ice can meanwhile support sea ice forecasting and polar operations that rely on navigating the Arctic ocean, including shipping, research, tourism, emergency management, oil and gas exploration and fishing. Although other measures of sea ice are available, they tend to be limited to ice extent or area, rather than thickness and volume which are often the determining factors when it comes to navigation.

Finally, both ESA and NASA have established approaches to supporting businesses in accessing, utilising, and commercialising the research and technology they support, which may be applicable. NASA's Technology Transfer Program[14] is the more advanced, but both organisations are already showcasing how their technologies and data are being translated into public services and commercial products.

Q18: Are there any other areas that we should look at as a priority?

[14] https://technology.nasa.gov/

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Increasing visibility is best achieved though collaboration. This has been essential to building COMET and CPOM's track records and reputations as EO experts.

COMET for example participates in the volcano and seismic risk pilot projects of the Committee on Earth Observation Satellites (CEOS)[15] Working Group on Disasters, as well as the CEOS Geohazards Lab. Both initiatives are increasing the use of EO data on geohazards for disaster risk reduction and response.

Alongside BGS, collaboration with the Global Earthquake Model (GEM)[16] is meanwhile developing methods for incorporating InSAR data into the Global Strain Rate Model (GSRM). COMET and GEM are also collaborating on a regional seismic hazard model for Central Asia, and as part of the Global Volcano

[15] http://ceos.org/

[16] https://www.globalquakemodel.org/

Model (GVM)[17] we have set up a Global Volcano Deformation Task Force which will compare global volcano deformation measurements with satellite thermal and gas observations, and make these data more available to volcano observatories.

CPOM also leads and participates in a range of high profile collaborations. The Ice Sheet Mass Balance Intercomparison Exercise (IMBIE)[18] is an international collaboration of polar scientists using satellite data to provide improved estimates of the ice sheet contribution to sea level rise. The latest IMBIE assessment, published in June 2018, has to date been covered by 226 national and international news outlets.

Building on our lead role in the ESA Climate Change Initiative[19], CPOM's participation in the Copernicus Climate Change Services[20] (C3S) project is also helping to provide consistent and authoritative free and open information about climate change based on the best available EO data and science.

These are just a few examples - the UK should also maximise its membership of the Group on Earth Observations (GEO) and the GEOSS approach to data sharing. This should help to ensure that global EO data is accessible to UK users, and can be used to develop new tools and services.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The organisations mentioned above (ESA, GEO, CEOS, GEM, GVM, IMBIE, CCI, C3S) are key players in the use of EO data for natural hazard management and climate assessment. There are many UK partners involved, including CPOM and COMET, who would be able to advise the Commission on best practice and future direction.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[17] http://globalvolcanomodel.org/
[18] http://imbie.org/
[19] http://esa-icesheets-antarctica-cci.org/
[20] https://climate.copernicus.eu/

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Conveyancing Association
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**x**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We do not have sufficient expertise to provide input.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We do not have sufficient expertise to provide input.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We do not have sufficient expertise to provide input.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One million property transfer transactions are registered at HM Land Registry every year, a further 34% of transactions don't make it to completion mainly because of the delays in the process and information which comes up after the sale is agreed but which would prevent the buyer from proceeding either in relation to the property or the funding required for the purchase.

HM Land Registry data is inaccessible other than the basic information. The digitisation of documents held by them would help process key stages in the conveyancing transaction and provide information to a potential buyer in a digestible format prior to viewing.

Stamp Duty Land Tax data is submitted to HMRC on the transfer of a property but this data is currently not accessible to HMLR or the conveyancer. On the sale of the property this data could prevent seller identity fraud because the conveyancer and HM Land Registry could verify data such as the National Insurance Number,

dates of birth, etc to establish that the person they are dealing with is the genuine seller.

Similarly, providing HM Land Registry access to the DVLA and Border Control data would enable them to affix an official photograph of the Registered Proprietor to the Registers so that anyone transacting with them could easily ensure that they are dealing with the true owner.

Water Authority data is also inaccessible other than through Water Authority Searches. This causes additional costs burdens where only core data, such as connection to mains water and drainage and the route of pipes and sewers, is required but the consumer has to pay for the full search product which includes information irrelevant to the conveyancing process eg water pressure, etc.

Similarly, the exact route of drains and sewers would be extremely helpful to property owners when considering extending or altering their property and therefore with no need to carry out a full Con29DW drainage and water search.

Survey and Valuation datasets held within the private sector could also provide valuable information during the conveyancing process.

Obtaining information, held by both private and public bodies, relating to the management of Leasehold estates or managed Freeholds adds an additional 20 days to the conveyancing of these properties. Having immediate access to these datasets would inform potential buyers of their financial obligations prior to viewing and offer, and reduce wastage through transactional failures and delays.

There are issues with the quality of planning and building regulation data dependant upon the systems used and accessibility permitted by the Local Authority. Whilst the planning portal is a helpful asset it is hit and miss. Enabling access to the datasets would speed up the home moving process whilst at the same time making the planning process more transparent and providing valuable information to emergency services on changes and access to the building.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data and the identification of land and the buildings located on it is currently flawed. HMRC work off the UPRN for the Stamp Duty Land Tax Return but HMLR use their Title Number. There are difficulties where the taxonomy of flats is non-standard so that a Ground Floor Flat might be described as GFF Acacia Avenue or Flat 1 Acacia Avenue, Flat A Acacia Avenue or Garden Flat, Acacia Avenue.

Changes will therefore need to be introduced to either standardise addresses or link them to one agreed unique identifier which should be attributed to the property when it is allocated planning permission. There is a problem in property where a plot is given a plot number which changes through the conveyancing process to the postal address. This means that some lenders have to re-issue mortgage offers to update them with the postal address and that some documents stored at HM Land Registry refer to the Plot rather than the registered address causing confusion and, in some cases, necessitating Deeds of Variation.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We do not have sufficient expertise to provide input.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

A big issue in the conveyancing sector is the inability for systems to integrate with each other and this is the same across all of Government and industries. Basic standardisation of field names would go a long way to enabling datasets to be interoperable.

If all users of Government datasets and all Government departments and Local Authorities were required to provide an API then this could be avoided and data could flow more easily.

The development of a form of Babel fish technology which can translate one

dataset into the appropriate field names of another database would assist.

In the property transfer process much of the 18-week process is the collation of data which will be lost once the transaction is completed. By storing this data in an authenticated ledger then it could be accessed for the next transaction.

Distributed ledger technologies should be supported to establish their workability for this purpose.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

We do not have sufficient expertise to provide input.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We do not have sufficient expertise to provide input.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We do not have sufficient expertise to provide input.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We do not have sufficient expertise to provide input.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes, please see our answer to Quesitons 4 and 7

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We do not have sufficient expertise to provide input.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We do not have sufficient expertise to provide input.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Create industry and regional working groups to input into the single UK strategy and feedback to their industries and regions as the strategy develops.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Resource the Local Authorities independently for this purpose. Local Authorities are required to be the custodians of many geospatial datasets through regulation and statute and yet the requirements have not in the past come with any ring-fenced funding meaning they have had to find funding within their own budgets.

This has resulted in failure to maintain datasets, for example many Local Authorities have not had the funds available to create a register of contaminated land required by the Environment Protection Act 1990.

The creation of webforms for all applications to Local Authorities coupled with properly resourced and mandated standardisation of datafield taxonomy and the provision of an API would immediately enhance coordination whilst leaving Local Authorities free to chose their preferred system supplier and maintain competition amongst the suppliers.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

96% of home owners say that they did not receive sufficient information prior to making an offer on a property. Even during the conveyancing process, as the data is collated, it conflicts with with previous information generating additional enquiries. If Local Authority along with other public authority and private data was accessible at the point of marketing and used to populate standard and pan-industry approved datasets, we could remove much of the conflict and confusion through the process.

If a lender, and their valuer, was able to assess the available property data and open banking data they would also be able to provide a binding lending decision within a matter of minutes.

Current conveyancing transaction times are 18 weeks.

One million residential properties are transacted every year. There are another 340,000 transactions which fail. That equates to 2.68 million families in economic stasis for up to 18 weeks every year. They can't book holidays, buy sofas or arrange removals because they do not know when or if they are moving.

By freeing the barriers between geospatial data, huge economic value could be derived, not to mention the positive emotional impact of a smooth and efficient transaction.

Q18: Are there any other areas that we should look at as a priority?

Access to datasets to assist emergency services.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We do not have sufficient expertise to provide input.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We do not have sufficient expertise to provide input.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We do not have sufficient expertise to provide input.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Costain Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Legal representative	
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Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes, although this term might be confused with data types (ie vector vs raster, point vs line vs polygon)

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial analysis, automation/programming/software development, systems integration, Web sharing capabilities, IT/Networks.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Better knowldedge of geospatial applications, how they can be used, and what they can offer. More information on disciplines that Geospatial can be applied, perhaps some media pieces on existing projects. It would be beneficial to raise awareness using TV/Radio programmes, social media etc. Also, including relevant modules in Education (primary, high school etc) will help with thinking spatially/being location aware from a young age. Career fairs in Universities promoting Geospatial will attract attention, as well as featuring Geospatial professionals in publications etc.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Utilties data are notoriously difficult to access, and even after overcoming hurdles, most datasets are out of date or of poor quality. It would be extremely helpful to have complete and accurate up to date utilities data, so that damages to existing assets can be avoided, faults could be more easily located and fixed, saving time/fuel/loss in efforts to maintain services.

Improvement: Inspection and capture of assets using mobile devices and GIS-> Asset data consolidated in centralised databases/datasets on servers-> Access to the data via open source WMS services. Also standardised formats, coordinate systems and data accuracy to ensure interoperability between software/systems.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data will need to be more publicly available, in a format that can be easily consumed in GIS applications (ie Rest services, WMS or shp). Locators like What3Words are now being used in order to accommodate for places with no detailed address information (ie large depots).

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Data readily available, contemporary and in a format that can be consumed by most applications. Important to make it easy for interested parties to order/consume EO data with minimum processing required. Web services and data portals could be used as a medium for such services.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Big Data, machine learning algorithms, cloud storage.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Location is key in most operations, having geospatial data and maps embedded in systems can help with decision making and creating insights out of complicated/flat data. It is imperative to ensure interoperability and data format/standards in order to achieve systems integration.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Technology in the form of mobile applications and portable devices can reduce costs in data collection/inspection on the field. Using GIS software and databases, data collected on the field can be seamlessly recorded in an organisation's main database, thus removing any work duplication and increasing efficiency. From that point, data can be made available to the organisation to schedule maintenance, organise operations and reduce redundancies. It can also be shared with the public in the form of a map service which can then be easily accessed by interested parties.
This will require investing in robust IT infrastructure (web servers, adequate bandwidth etc), appropriate GIS software and of course trained personnel.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

In many cases, there are no geospatial data available, only PDF files or online map viewers. In other cases, CAD data is provided, but without spatial location information or in the wrong measurement unit. It is sometimes the case that the data is over-generalised or too outdated, making it of little use to the public or private sector.

By establishing format standards (ie shapefiles or REST web services) and sharing mechanisms (ie not flat files like PDFs or images) these datasets can be more easily used across other public sector organisations to improve their services to the public. It can help citizens engage more with their local communities and also help the private sector improve how their operations.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Advocate for better format standards and sharing methods, opening up more datasets to interested parties. Work towards ensuring that any future actions take into account interoperability and systems integration.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Demographic data
Crime data
Purchasing habits
Health data (anonymised)

Spatial data attached to administrative boundaries that could provide insights on crime analysis, health analytics and public services.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Key points in strategy should be similar across geographies, ie formats, standards, interoperability goals, accessibility goals. Communication channels between regions should be open and in a collaborative spirit, however taking into account that there are bound to be differences across regions

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Sharing of success stories using location data (ie map portals, storymaps, relevant articles in social media or publications)

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Infrastructure &Construction: mapping of works location, stages of development, utilities in the area, 3D models of project for public engagement/consultation. Mapping of environmental contraints in the area, transportation routes to/from sites. Condition of road network and facilities to improve productivity and reduce waste. Good quality property information to assist with planning applications and orders. Public engagement and feedback maps/portals for members of the public to engage more and provide feedback.

Q18: Are there any other areas that we should look at as a priority?

Telecommuniations, Health, Crime, Human Resources.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Conferences and seminars: Attending and hosting, participating in events that target multi national audiences. Shows and media content relevant to geospatial data and technologies, starting internally but gaining international traction. Collaborations with international bodies and organisations, participating or establishing committees of geospatial focus. Contribute to establishing industry standards. Offering of more PhD/MSc/educational courses in Geospatial technologies and data.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

USA, Germany, Singapore, Netherlands, Taiwan, Australia.
Geospatial data play an important role in decision making process for public sector, both 2D and 3D. Freely available Open Gov data, in various formats and reasonably up to date. High academic credentials and educational courses in GIS offered in these countries. GIS applications in non traditional areas such as agriculture, finance and legal.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Geospatial Cooperatief UA/Critigen UK
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Given current trends, we feel that the definitions could be expanded to include concepts such as 3D data, BIM and time. Traditionally geospatial data is often 2D data with a set of attributes, but additional dimensions such as elevation and time are more and more common, particularly in sectors such as AEC and asset management which are quickly driving technological change in this direction.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

A supporting geospatial educational strategy strand would assist in ensuring future capabilities. The strategy should focus on how to more effectively integrate geospatial education at primary and secondary levels to get students thinking spatially. This could be coupled with the general drive in digital awareness and code writing and technological focus now being promoted at a much earlier age. At higher levels of education there should be a focus on incorporating geospatial thinking and technology more widely throughout the curricula and within degree programmes. Geospatial thinking is often limited to geography departments, where it is obviously vital and appropriate, but has applications in a much wider areana which are only now beginning to be understood with the proliferation of mobile and app driven awareness. Further integration of geospatial into education at all levels, particularly secondary to get students thinking spatially/technologically has moved from being a future need to one of the moment where skilled thinkers and data scientists are becoming prized corporate assets.

The commission could also focus on integration of geospatial data, technology and skills into other business areas and applications to lessen what is often viewed and utilised as a separate and occasionally ostracised role within an organisation. Integration of geospatial technology in business processes, backoffice applications, etc. is extremely useful, leading to new insights and efficiencies in both time and money. This could be tied in to strategies about improving productivity in the workplace. As a company, we specialise in this type of geospatial integration work and have successfully delivered geospatial integration projects for a variety of clients both in the UK and abroad leading to efficiencies and the resultant productivity gains within those organisations.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Within the geospatial industry there appears to be perhaps an oversaturation of technician and analyst level practioners, but a gap in more highly-skilled code-focussed software developers/configurators to build or configure geospatial applications. To address this, some level of scripting/coding in geospatial languages such as python, javascript and geojson should become part of the main stream education and a must have within university or post-grad level geospatially-focussed courses. It is no longer sufficient to be able to simply use a tool. An understanding of how to integrate it and extend the reach of pervasive geospatial technology is becoming essential. There also appears to be a shortage of more in-depth data scientists/analysts within the geospatial industry. This is a very popular field at the moment with very quickly-evolving technology and data, much of which has a geospatial element. Integration of data science into geospatial education is also vital at this point.

In order to promote careers in the sector, the government/commission might consider a marketing campaign around geospatial careers to help spark interest and to better educate the public regarding geospatial technology in general. Geospatial is currently a poorly promoted/recognised aspect of STEM education but it is an applied science discipline which we all interact with on a near constant basis.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Currently, datasets around AEC, infrastructure, etc. are lacking beyond what is available from the Ordnance Survey data. While some OS data has recently or is in the process of becoming open, opening up all the OS data would be valuable. The current licensing model is very confusing. The commission might also consider lobbying the government to open up all government collected data, similar to the US model where government collected data is generally free and open in an appropriately aggregated form, with the obvious exceptions of sensitive or personal data being withheld.

Additionally there could be higher quality or more in-deph data standards, both for collection and publication fo geospatial data. We recognise that data quality is a challenge for many organistions, and significant effort is required not only to create the appropriate standards, but also to ensure data meets those standards. A consistency of data structure enables efficiencies and appropriate usage. Metadata has undergone this process and now it is time for nationally collected data to follow a similar process.

The commission should consider procurement of a user-friendly national geospatial data repository. Currently many local authorities and other ogranisations have various data portals, repositories, etc., all being developed within their specific organisations and adhering to specific organisational data standards. This results in users having to search a large variety of sites, potentially for similar data that has (likely) been acquired and published to different standards including the data attributes themselves and the associated metadata.

National standards and repositories and data standards will allow the individual organistions to collect appropriate data in an appropriate way while leaving the publication and further use of that data to other ogranisations or companies that specialise in this. National standards can also increase interoperability between geospatial datasets and applications.

This type of wide ranging data availability fosters innovation, enabling forward thinkers and data scientists to quickly turn pilot ideas in to much wider use applications sure in the knowledge the data will be consistently available. Many great ideas of geospatial data use wither and die due to the effort of needing to translate multiple disparately collected versions of the same data subjects into a homogenous whole.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The commission should consider how postcode points may limit geospatial analytical work, an appropriate level of address aggregation and whether any address level data could be opened up.

It's also interesting that TomTom are now integrating what3words into their products. The commission might consider/discuss if and/or how this and other address concept may be useful in a UK context.

All of the above will be useful for implementation of emerging technologies such as autonomous vehicles and advancing already established technologies such as UAVs into new applications as yet unidentified.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

There has been discussion of making analysis-ready EO data openly available. Having this available across the country would be extremely valuable for all users of EO data with regards to time-savings and consistency of product. Particularly useful would be access to multiple datasets over time or from different sources for the same time period.

Requirements from a wide variety of stakeholders need to be understood for 'analysis-ready' data, and some users will still need access to raw data.

An appropriate funding model would also need to be developed to determine who contributes to the effort and whether or not the end-product would be freely available to the public.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission would find value in focussing on a variety of new technologies from a geospatial data perspective including autonomous vehicles/robotics, UAVs, big data processing/analysis, machine learning and AI, 3D modelling, augmented and virtual realities, and higher resolution EO satellites in terms of spatial, temporal and spectral resolutions.

One major area where little development has taken place to date is indoor geospatial connectivity and data usage. This particularly has potential in large arena venues from both a design and safety and security management perspective.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications can help target how and where to role out future technologies. They can help determine where the technology may be most effective in terms of usability and cost. This will also help maximise the benefit of the roll out and can lead to increased adoption of the technology.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Perhaps the most significant investments would be to make our geospatial data assets more accessible with more robust data standrards. The commission should consider procurement of a user-friendly national geospatial data repository. Currently many local authorities and other ogranisations have various data portals, repositories, etc., all being developed within their specific organisations and adhering to specific organisational data standards. This results in users having to search a large variety of sites, potentially for similar data that has (likely) been acquired and published to different standards including the data itself and the associated metadata.

National standards and repositories and data standards will allow the individual organistions to collect appropriate data in an appropriate way while leaving the publication and further use of that data to other ogranisations or companies that specialise in this. National standards can also increase interoperability between geospatial datasets and applications.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The commission might consider a strategy to update OSGB 1936. It is not easy to shift to a new datum, but certainly 80+ years of evolving technology could provide a more accurate datum. Perhaps it could be even be more compatible with current web mapping technologies.
The commission could also consider lobbying for access to the full capabilities of the Galileo system moving forward.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should have a consultant/advisory role to the commission as well as the role of innovator in the geospatial industry. The private sector needs support for R&D for applying its considerable motivation to innovate which it needs to maximise to compete on a national and international level.

Wider use of public/private partnerships, both local and national, around geospatial data and applications will help drive innovation, maximising the expertise resident within both sectors.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Our response to this is similar to some of the previous questions. For instance, the OS licensing model is rather confusing and the more OS data that can be opened, the better. Making more data available through web services based on open standards would also be ideal. But overall, the commission can help ensure that government bodies get the basics regarding standards and quality before making it widely available. Also, as mentioned previously, a national data portal would be extremely useful to avoid having to look at multiple local portals to find specific datasets.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The commission requires a mandate to guide the collection and standardisation of nationally significant data sets beyond those used in national statistical analysis such as infrastructure assets, EO data, land and property, temporal and ephemeral event data access.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There are multiple data sets that can be considered in this area such as traffic and people movement, public event management, local authority provision, health care and social services that are provided on a local scale. Infrastructure planning and social and economic development local plans would all provide insight to the nation and lead to more joined up thinking and potential cross border partnerships and alignment as well as a more targeted allocation of central funding.

This data can be made available as web services though data portals. These capabilities are either already present within many organbisations or readily and cheaply available through all the major cloud service providers. This data can be brought together to generate further insights and innovations not initially obvious from the original form of the data.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Create standards for the local authorities to follow and mandate that they provide data at specified periods to the appropriate central government body who can then publish on data.gov.uk or a new geospatial data portal that the commission can help create.

The Commission could set up local authority user group forums/meetings to share best practices, coordinate geospatial-related activities and to feedback on standards and on the Commission.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Based on our experience of working on major infrastructure and asset management projects in the UK, more focus should be placed on the time dimension of geospatial data as well as 3D data, tighter integration with BIM and augmented/virtual reality applications. As a company, we help organistions in both the public and private sector to drive efficiencies in their business processes by exploiting geospatial data and applications and integrating these into their standard operating procedures.

Q17: Are there any other areas that we should look at as a priority?

One area we have not yet mentioned that should be looked at as a priority is open source systems, which provide users additional freedom to customise and innovate applications that closed-source systems often do not. These open source systems will be developed to integrate with open source geospatial data and tools, thereby supporting an overall open geospatial infrastructure.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous vehicles/robotics, UAVs, big data processing/analysis, machine learning, 3D modeling/VR/AR, and “Frequent-Return” EO satellites are just a few examples of innovations requiring use of geospatial data to rollout. There are, of course, regulatory challenges, particularly those that function outside of a computing, data centre or office environment. Autonomous vehicles, UAVs and EO satellites all require significant regulatory frameworks with regards to how they operate within the physical environment. Regulation tends to be reactive to technology, almost necessarily so, but the quicker this can happen allows for a quicker introduction and adoption of the technology.

Q19: How best can we make the UK’s presence in the international geospatial world more visible?

The commission will need to develop a strategy that continues to build upon and raises the profile, perhaps again through marketing campaigns, of what is already one of the stronger geospatial data framework/infrastructures in the world. Linking the national geospatial strategy with the UK Built environment strategy to create a Digital Twin of the UK’s built environment would create a world leading vision of the digital future.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

One point of comparison would be with the Federal Geographic Data Committee in the US, particularly with regards to dealing with interoperability between government departments across a vast variety of geographies in the US.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Cyient Europe Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**x**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The 4 elements defined of geospatial data types are considered accurate, however there are some elements which we suggest as a clarification within the descriptions.

It is assumed that the 3rd and 4th dimensions are included within this thinking.

The definitions under Geospatial data, Positional data and Geospatial identifiers talk of "anchoring" position, which is key for fixed or permanent infrastructure however the element of flexibility of data will also be key. In particular data needs to account for temporal and mobile elements, which are particularly relevant to referencing in autonomous vehicle applications or where events may be temporary or pop up in nature.

Under item 4 for Geospatial services, we would make the observation that these elements are becoming democratised and that there is a move away from the notion that Geospatial services may only be provided by high skilled and trained geospatial professionals operating within complex (and expensive) specialist GIS applications. It is inevitable that such high-level applications will remain key in the area of resilience and the management of critical infrastructure, particularly to drive integration. However, a main driver for growth would be expected from less complex geospatial data that would not require a heavyweight application and may be built using open source options.

Scope
In noting the Partner Bodies datasets as the focus of the scope of the work of the Geospatial Commission, this appears to exclude major sources of geospatial data value held within UK utility, telecommunication and infrastructure organisations and companies. Data held by these organisations not only holds intrinsic value to the organisation, but also holds the key to unlocking value and growth.

Value
Understanding the value of data at the outset is key. The value of government held datasets has never been in doubt in our view, much of this data is owned and/or managed by the six Partner Bodies involved and this data provides UK with an underpinning infrastructure of geospatial data which is unparalleled.

However, there remain significant barriers in realising the value of this asset through;

- the ability of industry and users to access or extract this data.
- the inability to effectively share and/or connect datasets, both between government agencies, and between the public and private sector.

Rather than being an issue of availability of suitable technology to access data, the fundamental issue appears to be more one of culture of protectionism surrounding datasets.

Whilst there may be a legacy cultural tendency of the geospatial professional to protect against plagiarism, it appears to be more governmentpolicy driven. Government requires its agencies to deliver returns on the value of their data; this value is typically measured in treasury terms based on the financial performance of the agency itself, rather than the wider growth that freeing data up may release. To reverse this trend, the relevant stakeholders and decision makers will need to have wider sector growth measures included in decision making criteria.

UK needs to unlock this value and issues of synchronicity and compatibility across datasets will be a key.

If we take as an example the value of the core datasets held within the six Partner Bodies, the value to each of their datasets would be considered as high and the result of significant investments. Organisations are protective of such assets.

If we then examine the efficiency of the lifecycle of data passing across these organisations there is replication in;

- data collection and maintenance activities.
- data management and dataset improvement projects.
- (successful or unsuccessful) architecture and IT infrastructure programmes.

It is against this combined spend across organisations in such activities that provides the benchmark against which data integration and sharing initiatives should be justified and growth measured.

Changing the mind-set is a significant challenge to be faced, but it is not insurmountable given clear vision and drive behind the need to change. It is important to note that the UK is not alone in facing this challenge.

Whilst value can be gained from improved connection of disparate government datasets, there is also value gained from learning the lessons from implementing new approaches and workflows created.

This presents a considerable export opportunity for UK PLC. If the UK can successfully establish the ethos, the model and the tools to release the inherent value of geospatial data then this would bring opportunity to replicate this in other nations and across the global market.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Comprehension of Geospatial data and visualisation – outside GI industry.

It remains the case that there is often a “wow” factor for those who are not from within the industry when presented with GI visualisations in reports, presentations and particularly in simulations and animations (either AR or VR). These tools can be powerful and serve to explain environmental contexts to planning, project management and predictive analysis.

There is a need to normalise the application of geospatial data to wider areas of policy forming and implementation and this could be supported by governmental geospatial heads and advocates embedded within departments.

The subject of geography however does not enjoy a high or attractive profile to many; the image of the old geography teacher pervades. A PR offensive may be required behind a figurehead to sell the success of the industry and the people in the industry and show that working in geospatial is interesting and innovating. This would be a trigger to attracting top talent from, for example, the gaming industry to make the next step forward in technology.

Specialist Skills
Geospatial Data Analytics / Data Scientist
This is a key area for growth and an area where skills are lacking. An analytical approach has been core to the geospatial industry and applications such as thematic mappingare well established.
However, more complex analytical solutions are the current requirement. These solutions require the integration of larger and more complex geospatial and non-geospatial datasets.
Typically "Big Data" solutions have been seen as the realm of the (engineering) data scientist and often ignore the element of geospatial. There are examples in

Smart City applications where the integration of large datasets has struggled to deal with location, particularly where there is a temporal element.
So there is a clear need for the current and next of data scientists to become more aware and able to incorporate geospatial data in solutions. There is an obvious route for UK universities to build specific geospatial modules for post graduate and masters level study.

Geospatial Practitioner
Whilst the Data Scientist may be considered the high skill level end of the industry. There is also a skills requirement at the more practical, or geospatial practitioner, level. If growth is to be measured in jobs, the numbers of opportunities for data scientists would be far fewer than data editor roles. For such roles, there are few recognised routes to education or training, mainly consisting of a module within a geography related degree. A modern apprenticeship route would be far more appropriate with associated certification and accreditation of candidates.

SMEs and MEs in particular struggle with attracting and retaining talent. Being able to provide a route to geospatial qualifications whilst supporting associates through industry experience would help in both areas.

Geospatial in School Education
In the longer term, there is a case to embed geospatial much more in schools, both primary and secondary. Although there is a geography element at Key Stage 3, the takeup of geography as a GCSE subject is around 250,000 students and at A level this drops to just 30,000 students. However, more worryingly it is possible to reach this level of education in the subject without once using computer based GI. Despite the free availability of commercial GI application software and datasets, the uptake of these facilities remains very low at around 20% of secondary schools. The upskilling of teachers is required as a national strategy.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Skills needs and retention in Cyient
The two key areas of Geospatial Data Scientist and Geospatial Practitioner are areas where Cyient faces recruitment and retention problems.

The small number of associates with the high end skill sets are highly valued and their skills are in constant demand. If we could source more candidates with these skills, we could increase our capability and fuel innovation led growth.

We also face increasing challenges in sourcing and retaining associates at the Geospatial Practitioner level. We have a need for a level of seasonal flexibility within our projects and the majority of staff serving this need are sourced from other EU member states. In recent months this has become significantly more

challenging and this is a situation where we expect to become much more difficult in the near future. We will face a considerable challenge in filling roles with the required skill set and it inevitable that we will have to reduce our entrance criteria.

Geospatial Careers
Geography is a valued degree, but is also often viewed as generic, with skills sets leading into non-geospatial roles. This is likely to continue as the volume and access to further geospatial, earth observation and other imagery data grows and applications grow.

Associated with this growth, we would expect to see a need for wider geospatial application knowledge and awareness in roles such as computer programming, data science and web development as well as a need to upskill sales, marketing and project managers to have some specific skills in space and geospatial.

For these roles, alongside the GIS and Geospatial courses that do exist, there appears to be a need to revamp and update, along with strong encouragement to engage with companies in the sector to present and indicate the career paths available to students. Recent events such as Space Careers Days and the promotional work of the Satellite Applications Catapult provide good models and these should be encouraged, copied and supported.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Whilst HM Land Registry polygonised data is registered to Ordance Survey OS Mastermap data, both datasets are difficult to access, unwieldy to manage and integrate.
Currency of real world features do appear aligned but an integrated pre-build data layer would be a significant improvement.

The HM Land Registry programme of Local Land Charges and their Digital Street initiative will both deliver improvements to the process conveyancing, however an acceleration to both of these programmes is needed.

Current telecommunications and utility projects witness significant delays in progress due to Wayleaves, Ownership and initial design phases as Utility and Telecommunication companies struggle to determine land or property ownership to enable optimum planning and consent to be achieved. This is of particular relevance with the current 4g and 5g roll out programme in the UK. This issue is made more difficult with the variable currency levels of PAF data and the location of addressing in the pre-build environment.

Infrastructure and energy programmes, construction and development activities

also see this delay and the search for data using more integrated geospatial will bring together process faster and more efficiently.

Similar connections and benefits can be achieved across the DEFRA family of agencies in particular Environment Agency and Rural Payment Agency datasets. There are replicated processes, such as ground inspections, and connected mapping and planning processes would improve efficiencies and release opportunities to generate income from new products and services

The national utility infrastructure networks both over ground and underground reside in both public and private hands. Most nations see key assets such as utility networks as critical infrastructure with assets to be fully geospatially captured and maintained. The UK has lagged behind in this regard and so has not been able to truly benefit from a connected electricity, gas and water network. UK policy and legislation dictate that independent utilities must compete and companies therefore see infrastructure asset data as commercially valued information and this works against data sharing as this may provide competitive advantage to others. This requires government investigation and intervention.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Emerging technologies represents both an opportunity and a business model challenge for address datasets.

The issues of address format, definitive or descriptive variance, position, precision, currency and format are growing in significance and the importance of this does not appear to have been grasped.

That the address system in the UK remains based around generalised postcode sectors is archaic and of dubious significance. Despite this, ownership of the system is now in private hands and indications are that extracting value from the current system is prioritised over investment into making the step changes needed to deal with the issues identified.

With the emergence of pay on demand, premium and freemium models as can be seen in many apps, the demand on address location become greater as does the access to the data itself.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Earth Observation data has until recently been seen as the domain of highly specialist satellite and aerial imagery providers, with high cost of acquisition and processing passed to the market through high end user prices.

This picture has changed. Earth Observation is making its way into the mainstream and exploitation of the exponentially growing number of new (low cost) mini and micro satellites, UAV's and High Altitude Vehicles means that imaging the planet daily is now a reality- we effectively have geostationary platforms with the ability to provide an essentially real time view.
Acquiring data is no longer the issue – instead the challenge is how to handle the huge volumes of data and how to manage, exploit and serve this data into products both on the local and global scale.

The Satellite Applications Catapult with its progress to date is a prime example of how government support into a sector can, and continues to, make a difference. With such a plethora of SME's and ME's in this sector sometimes trying to break out of just UK plc work is challenging, yet through the IPP programme, Space for Smarter Government and other initiatives EO is now recognised by government as being of significant value.

The Commission should look to follow some of these competitions, innovation sprints and the increasing drive to bring government departments and industry together more regularly to deliver solutions powered by Earth Observation data. Industry has been the pace setter here and government policy and initiatives are lagging behind and need to speed up.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Cloud.
Cloud based processing from Amazon, Azure and Google represents a vastness of resources never previously available and these resources will become the default option for many big data and analytics applications. License charges and on demand charges for such services will become more significant as greater reliance is placed upon these services. It should be noted that many of these services are provided by non UK companies and therefore any dependency on such providers will attract risk.

The tools and skills to take full advantage of this technology are still evolving. The Commission should provide environments to support responsible learning of how to use such tools. As the need to both use the tools and protect the data provides a unique dilemma to government.

AI/Machine Learning: the vision of how computing will evolve is fast becoming the reality. Indeed, in geospatial applications such as remote sensing, machine learning is fast becoming the standard approach for change detection, automatic recognition and classification. This is a step change to the traditional approach to photogrammetry and GIS, although AI and machine learning are being driven by

engineering applications rather than the geospatial industry. However, a divergence would be expected. Geospatial products could conceivably learn how to collect and build themselves.

Blockchain – Geospatial data lends itself well to this approach and block chain could be adopted to both protect and grow datasets.

Internet of Things: Geospatial data again lends itself very well to IOT applications and could be seen as a suitable platform to serve IOT gathered data to users - for example to the citizens of the Smart City. Geospatial data will therefore have to be flexible and dynamic enough to respond to the changing use cases.

Crowdsourcing: National mapping agencies, in particular, have been reluctant to accept crowd-sourced data as trustworthy and usable input data, highlighting concerns over invalidated, insecure or fraudulent threats. However, this reservation appears unfounded and many applications are now driven and aimed at social media interactions.

The Connected Environment
The increasingly ubiquitous nature of connectivity to mobile and wireless networks will influence the geospatial industry as the typical view of complex data requiring heavy processing in a disconnected environment is becoming less applicable. The assumption is that real time will be real time, both in building and maintaining geospatial data, but also in serving this to users and consumers.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

New geospatial data applications as with any prototype services, should be allowed to fail as well as succeed. Some applications will only have a temporal or temporary value, relevant for short periods of time.

So accessing an environment that can be established as reliable, secure and easily accessible allows for increasing options to exploit and create new services. The limits in such an environment are seemingly endless and have the ability to resolve many problems be these governance, industrial, societal, economic or cultural.
If we take a view of the health and social care sector in the UK, which is the largest employment sector and attracts the most government and tax spend. The NHS and social care systems have at their core a reliance on medical professionals being available in the right place, at the right time, to deliver a service according to a demand. With the integration of geospatial data, coupled to the use of IOT tools and smart sensors, a new common operational picture of service demand could be envisaged that transforms the way of utilising capacity. This could end the “postcode lottery” which has attracted such adverse media

coverage.

The advent of dispersed technical hubs, regional centres and increasingly widespread bandwidth capacities could facilitate a change to working patterns and where business is located, decreasing the high demand in SE England and distributing into other areas. The “Northern Powerhouse” could be a data driven reality.

There is an expectation that UK cities will all become Smart, or smarter. This will provide the tools for the city manager to better direct resources is a society of ageing population, increased resilience and a changing crime and disorder profile. Reliable and fit for purpose geospatial data must be at the heart of this, indeed should be considered an underpinning infrastructure as important as utility or telecommunication networks.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Capability and capacity to collect, manage and analyse geospatial data should be viewed holistically according to the needs of the UK, both from a governance and taxation spend view.

The overlap between service provision by the public sector and the private sector needs to be understood and policy defined to drive the correct behaviours in both sectors.

There should be clarity around the currently muddled thinking around which sector should do what.

Drivers for government agencies to develop commercially facing services and make profitable returns in addition to delivering their public task should be removed.

Public sector involvement into the domain of private enterprise serves to introduces false competition, open up accusation of government subsidising commercial enterprise and can skew the markets.

In the geospatial sector we see this from the Ordnance Survey and its Ventures business and also the Environment Agency operating LiDAR and Aerial imagery capture programmes using its own (government subsidised?) equipment - whilst sufficient capability exists within the private sector to provide these services in an effective and affordable manner.

These types of public sector action risk stifling investment and innovation in the private sector.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Whilst a UK national view towards defining frameworks and setting standards for interoperability brings benefits to those operating within the geography, the global view should be adopted and take precedence and international standards applied and complied with.

Not to do so will serve against the UK's ability to develop the global market opportunity described in Q1 as lessons learned may be nationally applicable rather than internationally adaptable.

Consistency is really the requirement here - for example a common approach to understanding what constitutes "permanence" across geospatial datasets.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As mentioned in the response Q8, "fit for purpose" geospatial data must be at the heart of this, indeed should be considered an underpinning infrastructure as important as utility or telecommunication networks.

Industry is usually at the forefront of moving technical thinking forward and commercial activity leads. However, it is also recognised that in striving to gain a competitive edge through finding a USP, industry can often pull in different directions.

So the public sector has an important governance role to play, not only to dictate direction, but to mediate and define where there may be conflicting interests.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Licencing is and will always remain a key challenge.
We understand the need to protect Crown Copyright, however with the advent of the internet, cloud computing and web applications, the licences for data, and how it is used, seem not to have kept pace and so are inadequate.
This will become even more of an issue as the drive for integration and sharing grows.

Geospatial datasets are at times over-engineered with added complications caused in accessing the data. Many facets of data products are suppressed or removed before the data becomes manageable. This is a well known issue with OS Mastermap's use in utilities and serves to discourage the use of the product in preference to a less suitable but easier to manage product. There is a case for a "light" version of this product.

Perhaps a commercial entity managing the use and access to national mapping datasets would enable cost savings, while alsoencouraging more innovation when it comes to the use of, and access to, UK mapping and geospatial datasets.

The Commission should look outside the traditional governance of data and be prepared to consider not just what the data is, but how it is accessed and how growth could be generated through its adoption. Web developers, virtual/augmented reality and the gaming industry could make use of geospatial data in diverse and innovative ways in ways that the government owners have not yet fully embraced or adapted.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Cyient welcomes the early moves by the Commission in regards to its responsibility towards the management of the PSMA, the One Scotland Agreement and Aerial Photography Great Britain contract. However this is based on the assumption that the management, transparency and open tendering aspect to these contracts is retained and improved upon.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Access to datasets which would open opportunity to create growth could come from;

- Access to the core OS Geobase04 dataset from which the OS Mastermap product is created, without the filtering introduced to create the product. the raw data)
- Rural Payment Agency parcel boundaries dataset (of field boundaries)
- Parking restrictions datasets, including notices, controls and locations
- Refuse collection routing
- Traffic calming and restrictions notices
- Cycle routing core data

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Standardise on data formats, styles, symbology.

Access to LA held datasets which should be considered in the public domain or for the public good through a centralised hosted hub, accessed via central supported portal, allowing access to all users.

This portal could also host served GI tools and applications for all to access and create lightweight applications as well as support and help when it is required.

It is accepted that the LA's have taken a range of different approaches, even to standardised datasets, and so no authority should be hampered because they cannot afford to support a GIS manager or geospatial data experts.

Therefore, LA's may be supported through the process of lodging their data through regional or local technical centres (virtual hubs) using expertise from trade organisations such as AGI or RGS, who could potentially offer an outreach route that could significantly reduce regional imbalances.

Once lodged, datasets could be verified and validated at the hub using automated tools.

This hub and portal could also offer use of web tools for training, data access and strive to enable remote users to access and benefit from government geospatial tools. A better connected government network would reduce logistics and increase value.

Consider the case of a digitiser or analyst working in remote locations andfacing barriers to collaborating - and not being able to afford the facilities of those authorities able to support development into tech cities (London, Oxford, Cambridge). Through this centralised approach, these authorities may be able to build GI based services and in addition gain access to a wider GI community with the ability to engage with open source community, citizen science and wider global initiatives looking at how to solve challenges through the power of

geospatial data
With the United Nations now having dedicated geospatial networks, the UK has a prime opportunity to engage and present on the global stage.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

All of the areas outlined are considered high value and most already enjoy a range of existing dedicated software applications designed specifically for the need of organisations operating within the sector.

We would seek to build a more detailed picture of the pains faced, and the specific problems to be resolved, within each sector or organisation.
it is recognised that it may be existing software applications provided off the shelf are typically generalist and are often actually the source of this pain.

We look to this further level of definition before we comment specifically over development of existing or enhanced applications.

Q17: Are there any other areas that we should look at as a priority?

Health and Social Care – as mentioned in our response to Q8 - remains one of the greatest challenges for the UK, and geospatial data has a chance to start solving major challenges such as joining locations of patients and appropriate resources.

Whilst infrastructure and energy, along with local government projects, lend themselves naturally to mapping work, the need to improve health – both mental and physical - and the pressures of an ageing population are less simple to identify.

Geography has a massive role to play in improving health from the environment in which we live, the quality of the air that we breath and the water we drink, to the role out of social care and as an enabler for the nation to move more.

The Commission should pay significant attention to the intelligent uses of the data held within government and the growing public data with a geographic context.

Simple questions such as “where are the challenges in the UK and how should we bring solutions to those areas” can be answered.
Predictive analytics may be used to assess the likely success of initiatives and be prescriptive to change behaviour in order to improve outcomes.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

All major infrastructure projects will benefit and there are good models being followed. Each in turn requires some level of regulatory change or re-interpretation.

A good example is HS2 which is, and remains, a heavy user of geospatial data in design and implementation and construction phases. We will witness significant requirements around planning but with frequently refreshed EO data the ability to rapidly gather the real work picture will play out not just into project progress but also maintenance regimes for the network

Road, Rail and the management of Coal Authorities real estate will benefit hugely from a combination of new imagery sources, UAV and the need to combine with UK geospatial and old map records the value is high.

Q19: How best can we make the UK’s presence in the international geospatial world more visible?

The International Partner Programme run under UKSpace Agency enabled previously highly competitive SME's in the Space sector to collaborate and deliver on a common external goal outside the UK. Such activity has seen international governments and organisations see the strength in depth of UK space and geospatial expertise. Similar structured competitions and programmes offer a UK government investment route into not simply businesses and agents, but projects that can stand UK PLC up as a world leader.

However, the UK needs more support for the startup community to facility the incubation of new geospatial companies and provide access to seed funding. The OS Geovation Hub is an example of such support - however this organisation is essentially driven by providing new revenue streams for OS Ventures. It could be that the next Mapbox, Waze or Carto will be UK based!

As Brexit looms the British Commonwealth remains a collection of diverse countries with common connections and an infrastructure of organisations and agencies with global geographical challenges which the UK could look to address.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

IPP Programme – UK Space Agency . EASOS in Malaysia and Philippines one such programmes which have benefited

The Australian Geoscience Datacube is an example of where another nation is taking the lead in this way

Softbank provides an example of how support and funding may be provided to seed innovation.

WGIC – World Geospatial Industry Council. Incorporated in the Netherlands.

Thank you for your time in completing your response to our call for evidence.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Defence Infrastructure Organisation
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

These would be more beneficial in diagramatic form.

Title for Part 2 is misleading - perhaps changed to Relational Data

Part 4 - Term Services is not in my opinion accurate something along the lines of 'Geospatial Insights' may be more appropriate

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Schools should be a big focus, many children are totally oblivious to GIS, its not now just about Geography, give children the skills to be innovators.

Educate children about Geography and GIS and what can be done with maps. Google is not the answer. Get current IT experts on board

Make the technology more accessible as well as affordable.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Best promotion is through local Chief Execs and Senior Managers. Understanding opens doorways for for Innovation across the Public Sector. Ministers need to take a lead.

GIS is still seen as a cost saver as proved by the reduction in resources and investment across many public sector departments. Use other sources such as Bing and Google.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Create a National Silo across the Public Sector to allow easy flow and sharing of data.

MOD still have to spend time sending emails to request information that should be readily available.

Generalisation of data sets to allow them to be more open as OS are currently doing.

Creation of standard data schemas for easier data handling

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

One set of Address Data, currently have LLPG and Royal Mail....WHY?

Nationalise Royal Mail to remove arguements over who owns the data, then create a single reliable address dataset

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

EO is curretly very specialised and focussed on technical users

High level of technical requirement as well as processing before data can be used.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Access and. Storage - Web feeds and development of Cloud Technology and User Apps.

Once freely available there will inevitably be more users.

Standard data formats enable data to be embedded across all systems and formats. Most users just want an end product and don't care how you got there.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

AI or IA (Intelligent Analysis)?

How can we predict future technologies?

Support for Autonomous Vehicles as an example...

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Invest more in the Public Setor and GI capabilities.

Basic resource currently fire fighting, maintaining with no innovation or enhancements.

Need Private Sector buy in.

National dependancy on data that is only as good as the people at the bottom who capture it.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Giving day to day users access to current technology. GPS signals on mobile phones needs to be accurate enough to collect field data without large errors.

Standardisation of Geo Networks???

5G network coverage, broadband and mobile infrastructure is getting better that will enable more viable solutions to be created.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Less focus on profit!!!

There is a lot of data in the private sector that would be a valuable source to the Public Sector

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Standards

Formats

Licencing

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

See response to Question 4.

Classic example of GML not being a standard format for everyone

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

British Standards made up of Local Standards from England, Scotland, Wales and NI

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Address Data
Land Titles
Web Services
Land Coverage and Ownership

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

In the Public Sector Addressing Data could be scaled up to include Land and Property. UPRN could be made more freely available to allow free sharing of datasets.

Q18: Are there any other areas that we should look at as a priority?

Invest to save!!!!

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Private Sector need to make key datasets more readily available. Need a sharing ethic across sectors

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Having a single UK body and a single Data Strategy.

Geo-Evangelise about what we do

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

USA
France -
Japan
Denmark

Thank you for your time in completing your response to our call for evidence.

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Defra's Chief Scientific Advisor's Office (CSAO) have championed EO and for 20 years UK policy lead for Copernicus and the Group for Earth Observation (GEO). In 2015, the CSAO created a five year Roadmap for the uptake of satellite derived EO across the Defra group, with catalyst being the emergence of free and open Sentinel data from the Copernicus programme. An Earth Observation Centre of Excellence (EOCoE) was created, bringing remote sensing experts, from across the Defra group, the National Centre for Earth Observation (NCEO) and the UK Space Agency's Space for Smarter Government Programme.

Four years on, collaboration on requirements and a sound Research and development programme has led to the creation of Sentinel 1 & 2 Analysis Ready Data (ARD); derived data products such as a crop map of England; applications; methodologies and data access and analysis portals. The EOCoE has expanded to work with the Devolved Administrations who have similar Environmental and business requirements to Defra.

Where the Geospatial Commission can help is by providing technical infrastructure solutions; commercial data licensing and data standards for across Government. The Geospatial Commission can offer what is not already being done, or what is not being done well, due to financial and technical limitations beyond the sphere of influence of one body. Different Government bodies will still wish to develop their own applications and produce derived data, but need the technical infrastructure and data licence assurance to make these affordable and resilient. The Geospatial Commission could act as a community hub to publicise proposed activities and allow departments to work together where there are common requirements. However, careful consideration would need to be given to avoid a central bureaucratic entity that stifles, rather than enable creative solutions across Government.

The Geospatial Commission could play an important role in bringing together military and civilian activities that use satellite and other data to ensure a more joined up approach across Government that delivers the best value for money.

Defra as the UK Copernicus policy lead would welcome working with the Geospatial Commission in helping to exploit the data coming from the Copernicus Programme. This may include providing Analysis Ready Data produced from the other Sentinels as they become operational in addition to Sentinels 1 & 2; encouraging Public and the Private Sector to make better use of the Copernicus Services; providing user feedback to Defra.

The GEO (Group on Earth Observation) programme, that Defra is the UK policy lead for, could serve as a model for the Geospatial Commission in promoting the free and open use of geospatial data and technologies to drive productivity, promote economic growth and improve the delivery of public services.

The CSAO supports the Geospatial Commission and looks forward to working with them.

Innovation Team, Defra Chief Scientific Advisor’s Office. 17/10/2018

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Deimos Space UK
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We would agree with the data type definitions

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Integration of geospatial data from IoT
- Social media data made geospatial (within the GDPR rules)
- Monetisation of users data (within the GDPR rules)
- Automation of geospatial data analysis (analytics, AI…)
- Integration of crowdsourced geospatial data
- Complimentary disciplines that have an appreciation of the particular challenges and opportunities of geospatial data, products and services. (Computer scientists, DevOps, Marketing, Security etc.)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Interdisciplinary data scientists, developers and DevOps with experience in geospatial datasets are more difficult to find than geospatial analysts.

Better recognition of technical expertise and technical career. At a certain level of career it is easier to be successful and recognized as a manager than a technical expert. How to get a better national or international visibility and recognition of technical expertise: Nobel prizes or grand challenge prizes for geospatial expertise!

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Training data for machine learning (vector data, satellite image chips for different features)

- Ordnance Survey data (In US, a large number of USGS data are freely and easily available)

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Making sure that the UK infrastructure is there to support such workflows – i.e. fast broadband, 5G, supporting small business in their resource requirements – cloud infrastructure can be a prohibitive cost for example.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

To provide thought leadership in shared resources, standards and platforms for industry to use as a springboard for future development. This should be in collaboration with existing UK organisations which are maybe already providing such resources and platforms (if suitable for such approaches).

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The combination of sensors across different temporal and spatial scales – interoperability.

Combining geospatial technology with new technologies such as cryptocurrency, ecommerce, natural language programming, chatbots

Supporting integration of local and dynamic geospatial data (from IoT and crowdsourcing or public institutions). Making available local (UK) geospatial data is likely to support the local UK economic growth where it is needed.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Spatially and temporally tailored front ends, data and insights for all kinds of applications – traffic management, logistics, maintenance of infrastructure, agriculture etc.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Data access based on crowdsourcing tasks – you can gain free access to data if you partake in a certain amount of either provision of data, or QC / validation / classification of data to make the data more trustworthy for others.

In the same manner, opening production of geospatial data to citizens contributions (signalling issues…)

Helping to identify/list/harmonise geospatial data provided by public services (police…) in one infrastructure/portal

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

RTK technology for positioning gives a much better location accuracy than GNSS for a much more economical infrastructure. It is underused today, but new chips on the market are starting to use this signal (e.g. drones, maybe mobile in the future?). The potential of RTK is maybe underestimated.

UK GNSS

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should play an active role in the development and maintenance of underpinning infrastructure, as they ultimately benefit from the data as well.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We would recommend more involvement in the OGC across the sector, and perhaps the government could sponsor some testbeds and challenges to develop standards for the community that private companies can then adopt, for sectors with high priorities in UK

In general there are too many portals and local initiatives producing geospatial data. Geospatial data could be produced following a UK guideline and possibly deployed on a limited number of portals.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Provide easy to navigate guidelines on how to best prepare, present and provide geospatial data for the public sector. See Q12

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

More real time data, such as traffic, vessels, flights etc.

Commercial, financial data etc. that satellite data can infer, in order to validate.

Citizens contributions (signalling issues, sensors…)

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Online platform where local authorities can have a presence – including forums, QandA, guidelines, standards etc.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Energy use, efficiency and consumption patterns
Smart farming
Pollution monitoring (air, coast…)
Forestry (management, protection)
Infrastructure monitoring (risk, activity…)

Q17: Are there any other areas that we should look at as a priority?

Finance and Commercial
Logistics
Agriculture

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

More automated monitoring and maintenance of infrastructure (roads, public buildings, utilities etc.) using digital in field collection. Fully digital asset tracking.

Data licensing issues preclude better use of data. Some security issues. More GDPR implications will become apparent as new geospatial technologies develop.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

By demonstrating thought leadership in standards and national platforms for open training data for ML, AI.

Potentially by hosting a Grand Challenge type initative

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The Resilient Cities initative is a good international project. Having a digital, geospatial focused version of that within the UK could be a useful activity.

Kaggle is a great example of an initiative that is starting to provide datasets for AI / ML, although there is still no standardised method of data collection and dissemination here. This could be taken as an example to build something UK focused.

Thank you for your time in completing your response to our call for evidence.

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Clearly title your email *'Call for evidence response'*. About you and your organisation

Name	[Text redacted]
Organisation	Deloitte MCS Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Almost all data generated today has some form of geographical reference which can be tied to a location and plotted on a map. As a consequence many datasets can be regarded as being 'geospatial' in nature.

GIS data is traditionally separated into two categories: spatially referenced data which is represented by vector and raster forms (including imagery) and attribute tables which is represented in tabular format.

- **Geospatial data vs Positional data:** The commission's view of geospatial data types suggest a hierarchy of whether the location component of the dataset is a key feature of its source or purpose. It's important that, as an industry, we are able to collectively agree whether a dataset is 'geospatial' or 'positional' i.e. the ability to plot that dataset on a map is key to gaining insight from that data (e.g. air pollution in a city requires geography for us to manage it) compared with a geographic attribute which *could* be visualised on a map to enhance our understanding of the spatial distribution of that feature (e.g. trees in a park). The 'usefulness' of the geographic component is also likely to differ depending on who is using it.
- **Geospatial identifiers:** Geospatial identifiers (or GEOIDS) are very important for understanding and interpreting geographic and demographic data and their relationship to one another. Without a common identifier users would have a difficult time pairing the appropriate demographic data with the appropriate geographic data.
- **Geospatial services:** These often call on the three data types above to fulfil a specific task. For example, a public transport journey planning mobile app could be called a 'geospatial service'. It takes the user's current location, converts the user's destination into a location on a map, then identifies the quickest or shortest route to get to that location. An estate agent may use a

geospatial service to identify crime statistics in an area or how house prices have changed over time. As a consequence, this 'data type' should be regarded more as 'products'.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial skills should be treated as a domain of the wider analytical toolkit of skills. At Deloitte, the most important answers to our clients' complex business challenges may be hiding in their data. Those who can make sense of the vast quantities of information at their disposal are coming out on top.

Consulting skills:

- **Critical thinking and problem-solving** skills to solve society's biggest challenges using geospatial data;
- **'Purple People'** who have the mix of red skills (i.e. software developers, data architects, data scientists, information designers) and blue skills (i.e. change managers, subject matter experts, design thinkers) - a combination that fosters the development of "purple teams" (https://bit.ly/2Cxn3Nr)
- **Communication skills** to use maps as a data visualisation tool to tell a story and communicate findings;
- **Basic programming skills** to automate repeatable geoprocessing tasks;
- **Consulting skills** and the ability to translate user needs to solutions in your domain.
- **Social responsibility:** Just because you can map something doesn't mean you always should. Consideration of the impact on society, someone's individual liberties or private information.

Geospatial data skills:

- **Geodata awareness** of common commercial and open source spatial datasets – how they work and when you should use one over the other;
- **Spatial analysis** skills using commercial and open source geospatial and business intelligence software to analyse geospatial data;
- **Data science** skills to analyse, manipulate and visualise data on a computer using machine learning and artificial intelligence.
- **App development** to build tools and services which are available on web, mobile and enterprise environments.
- **Generalisation** awareness and how it impacts calculations e.g. length or area and when working at different map scales.
- **Uncertainty** in geographic representation because almost all representations of the world are incomplete**.**
- **How to lie with maps** - the creator choses what to place in the map, and what to leave out and what story to exploit.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

What are the geospatial skills needs and gaps in your organisation?

In a world where the amount of information is doubling every 2 years, how can we keep up? Our Technology practice offers the full spectrum of analytics, including data management, automation, advanced analytics and managed services - often with a location component.

We discover our client's unique needs with them, help their business change and adapt, innovate together with creativity, design and build-out their agile solutions, whilst coaching and mentoring leaders at all levels. As a consequence we are always looking for passionate individuals to support our analytics capabilities with the following skills:

- A degree in a GIS related field or relevant experience in a related subject;
- Experience of planning and conducting geospatial data management at scale;
- Strong quantitative and analytical skills with excellent problem solving and conceptual thinking capabilities;
- Experience using products from key commercial vendors such as Esri, Hexagon and Safe as well as open source products such as QGIS;
- Experience of analytics packages for data manipulation, data discovery and presentation e.g. Tableau, Qlikview and PowerBI as well as ETL tools such as Alteryx, which all have some form of geospatial enrichment and visualisation components.
- Awareness of common commercial and open source geospatial data sets e.g. Experian, GeoLytix, census products and Ordnance Survey datasets.
- Experience of using APIs for accessing map libraries or geographic data;
- Data Analysis / Modelling / Business Intelligence skills;
- Ability to rapidly develop Proofs of concept;
- Data Visualisation and cartographic skills.

How can these be most effectively addressed?

- Deloitte recruit staff with strong academic and technical skills, relevant experience and good interpersonal skills.
- We also invest in maintaining skills:
    - Continuous Professional Development (CPD) activities e.g. professional education.
    - We operate an extensive programme of internal training courses delivered by experienced internal trainers or by external experts depending on the subject matter of the course.
    - Staff also have access to an online e-learning suite which provides access to over a thousand e-learning modules and online courses.
    - Alliances with major software and equipment vendors who provide training in new products e.g. new releases of software packages.
    - Attendance at conferences, vendor showcases and industry events;

- "Learn and Share" sessions and innovation workshops for specialist teams to share experience and ideas.
- Monthly meetings of sector account teams to maintain sector-level skills and knowledge.
- Domain specific newsletters and regular updates.

- Although Deloitte does not rely on subcontractors for delivery of core services we occasionally use subcontractors in specialist roles and require them to demonstrate the professionalism and high standards expected of Deloitte practitioners.

How can careers in the sector be best promoted?

- Grow the relationship with the open-source and developer community e.g. GeoMob, FOSS4G and the Open Data Institute (ODI) who promote open source technology and data across a wide range of domains and to users who do not have a traditional geospatial background.
- Promote Continuous Professional Development (CPD) and work with bodies such as the Association for Geographic Information (AGI), Royal Geographical Association (RGS), the new cross-government Central Government Geography Group (CGGG) and Head of Geography.
- Creation od a centralised list of national events from local meetups to conferences and trade shows to allow those new to the sector to network and meet others working with geospatial data. Promote free or low cost events e.g. both the AGI and Esri run regular events which are free to attend and include presentations from the public and private sector as well as networking opportunities and hands-on experience.
- Continue to promote geography and how it plays a crucial role in understanding our world. It makes a vital contribution to our knowledge of the rapidly changing environmental and social challenges facing us and how we should tackle them.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Data has become a part of our core national infrastructure, and a huge driver of innovation. At Deloitte we often fuse client, open-source and spatial data together for immediate visualisation and contextualisation of data to inform key strategic and operational decision making for stakeholders. Some of the most common datasets we work with are outlined below:

- **A single authoritative enriched addressing database.** Our consultants often handle addresses and require accurate geocoding and enrichment to carry out further spatial analysis. There are many sources of geocoding so a single source of truth would mean all consultants are using the same reference database. Published data would also have a common spatial location and enable ease of comparison and analysis.
- **A standardised way of storing and accessing geospatial data**, independently of the technology platforms and digital services that use them. We often need to source a variety of datasets from various public portals (e.g. NOMIS, ONS Geoportal, Ordnance Survey etc.) and considerable time is spent converting datasets to common formats (e.g. Esri Shapefile) or geocoding CSVs to plot them on a map.
- **Public transport data**, including stop locations and timetable information. Our consultants often perform bulk journey planning queries to support analytical projects e.g. a bulk multi-modal journey planning tool, similar to that provided by The DfT's Transport Direct website (which closed in 2014).
- **Drive time data** using a national road network dataset. Whilst national road datasets are freely available, accurate (and dynamic) road speed data tends to be offered only by the private sector and at some considerable cost. There are a wide variety of products on offer ranging from speed limits, average speeds and hourly profiles. Data is also often provided on the suppliers default road network which may not align with other road attributes held on a different spatial dataset.
- **Points of Interest** e.g. schools or GP surgeries. A single access point for authoritative points of interest. Overpass Turbo (which is based on OSM data – see https://overpass-turbo.eu/) is a good example of an open portal which allows a user to 'grab' specific points of interest.
- **Small area statistics** e.g. population projections, anonymised health statistics, consolidated datasets from various Government bodies attached to a common zonal geospatial dataset.
- **Anonymised footfall data** possibly sourced from mobile phone network providers. Our retail analytics team have previously engaged all telco-providers in the UK and discussed their commercial products which include footfall analysis. Often data from one provider is only available in one region so comparison of national movement (e.g. to analyse train vs air travel) becomes complicated.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Breakthroughs in self-driving cars and trucks are only the beginning: The entire way people and goods travel from point A to point B is changing, creating a new mobility ecosystem. The shift will likely affect far more than automotive and transportation companies - industries from insurance and health care to energy and beyond should reconsider how they create value in this emerging environment. Intelligent Mobility is the smarter, greener, safer and more efficient movement of people and goods around the world.

Deloitte is actively engaged across the mobility ecosystem, working with a wide variety of organisations - including automotive; tech; transportation; insurance; financial services; national and local government agencies; and beyond - to help them each define where they will play and ways they can win in the new mobility market.

  - Driverless vehicles (https://bit.ly/2AlEUFz),
  - Mobility as a service (MaaS) (https://bit.ly/2JxOMha)
  - Electric vehicles (https://bit.ly/2J8SKy1)
  - Passenger Drones (https://bit.ly/2DsaLI0)

- Driverless vehicles, MaaS technologies and drones require pinpoint accuracy to determine their location and route on the road. Current addressing systems don't offer that degree of accuracy. Current addresses assume an address is in the middle of the property or postcode but the vehicle requires the location of a building entrance point or, better still, an exact kerbside or parking spot at the front (Source: What3Words https://bit.ly/2PbM088).
- In addition, drones will require a 'vertical' address ecosystem to know, for example, which floor of a building it is meant to deliver a parcel to.
- Passenger drones will require proper take-off and landing zones, and parking and battery charging stations. A wide network of vertiports would require either new infrastructure or existing infrastructure, such as helipads, rooftops of large public buildings, and unused land, to be modified. To create a truly unified traffic management system, additional infrastructure may need to be installed along predefined flight corridors to aid high-speed data communications and geolocation. All these infrastructure changes would require the collaboration of commercial stakeholders and the local urban planning authorities.
- Addresses will need to support different *toponyms* – variant names and spellings. They often serve as symbols of regional culture and thus reflect the history, habitat and environment of a place.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

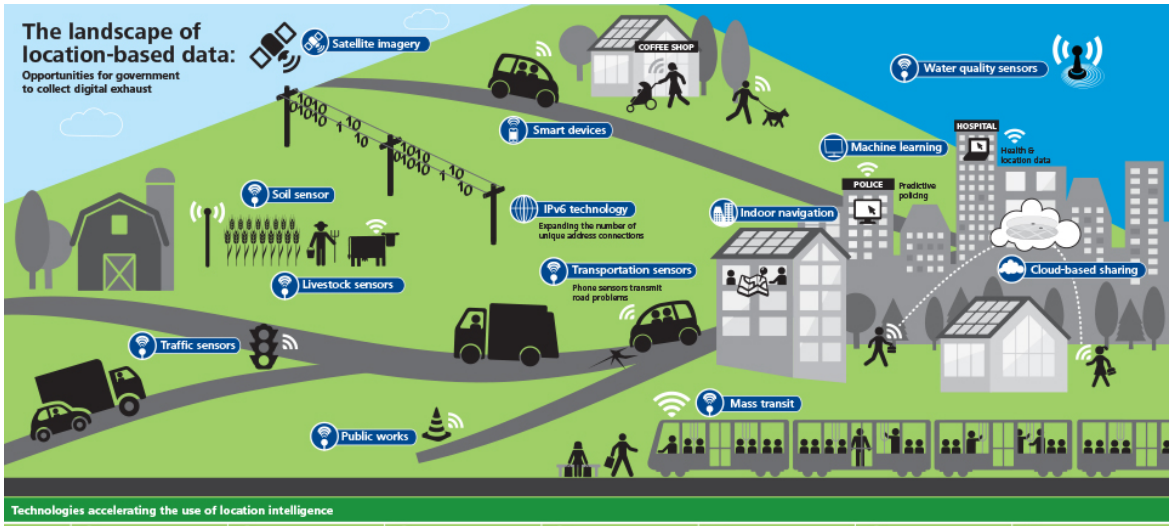
- Satellite data has historically only been available to specialists and scientists who use specific tools to interpret the data. Recently there has been an increase in Earth observation (EO) data being offered by both public and private satellite operators, which could benefit many commercial and research

organisations in the UK.

- The commission could help individuals and industry to understand where EO data can be obtained from and what the imagery can be used for. The Satellite Applications Catapult, an independent technology and innovation company, works with the UK Space Agency to provide an accessible 'Data Hub' that makes it much easier to identify where satellite data can be obtained and what it can be used for. Any organisation promoting the use of EO data should act as a catalyst in generating economic value from open data.
- The commission could review existing publically available EO mapping portals to review product offering and user access. For example, the Copernicus Open Access Hub (https://bit.ly/21NcnOp) and openaerialmap.org which provide access to openly licensed imagery and map layer services.
- Promote recent success stories such as using aerial thermography data to identify residential housing who could benefit from loft insulation. Quantitative techniques from the fields of remote sensing, GIS, building physics and atmospheric science are used to develop a methodology and analyse survey data.
- Collaborate with bodies such as the National Centre for Earth Observation (NCEO), The Satellite Applications Catapult and the Remote Sensing and Photogrammetry Society (RSPSoc) to examine the application of EO data to education, science, research, industry, commerce and the public service.
- Engage with major commercial providers of EO data, such as Digital Globe and emapsite to examine the range of products on offer and use cases to drive user adoption and education. Digital Globe, for example, provide a cloud-based platform to access critical location intelligence when a user's existing data and tools aren't sufficient.
- The commission could promote citizen science (CS) and crowdsourcing for tasks such as how they are using EO data and techniques and mechanisms to process and analyse EO data using advanced feature detection algorithms, machine learning and artificial intelligence.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Location becomes an integral dimension of data, allowing information patterns and decisions to be viewed through the lens of place. Since entities on earth can be tagged by location, Geographic Information Systems (GIS) finds varied applications ranging from movement of weather patterns to traffic management in crowded cities to location-based services to forming the backbone for the Internet of Things. The use of GIS in the field of medicine and infrastructure planning grows as governments open up their GIS databases for public use.



Technologies accelerating the use of location intelligence

Accelerator	'Smart' devices	Sensors	Cloud storage	Machine learning	Remote imagery	BIM/CAD/GIS integration	IPv6 technology
Impact	Mobile devices that can detect location, direction and movement, enabling context-based interaction between government and citizens	Sensors provide constant data collection about our physical and natural infrastructure, offering a vibrant picture of trends across a range of data sources	Cloud-based storage allows for the collection, scaling and processing of vast amounts of location data, and enables geo-data sharing	By 'learning' from historical spatial data, computer algorithms can scan new data to identify anomalies and patterns that yield predictive insight	A blend of commercial and government satellites, planes and drones provide a near real-time picture of the changing conditions on the Earth's surface	The Integration of Building Information Modeling, Computer Aided Design and Geographic Information Systems enables analysis inside and outside of structures	Internet Protocol Version 6 will expand the number of unique addresses on the Internet, improving geolocation
Today	Geotagged tweets and text messages are used to connect with citizens	Cities can monitor and track air quality to inform better regulations	Agencies share geo-data on a common platform	Law enforcement can create predictive models for violent crimes	Imagery provides awareness about events like natural disasters, migration patterns and foreign conflicts	Site planners and inspectors use GIS and building specifications to perform more uniform evaluations	Road signs, utilities and other infrastructure are connected to the Internet
Tomorrow	Government uses geofencing to push information to individuals based on location	Government can trace contaminated food to its source immediately, and even predict an outbreak	Real-time data from millions of sources are securely available anywhere, anytime	Unstructured social data becomes instant insight for policy makers	More granular imagery allows for remote monitoring of public infrastructure to predict future needs	Directions continue seamlessly from outdoors to inside buildings	Emergency managers rapidly assess damage using data points from thousands of inanimate objects

Graphic: Deloitte University Press | DUPress.com

Source: Deloitte (http://government-2020.dupress.com/driver/geospatial-technology/)

- **Geomedicine** aids clinical diagnosis by providing a more precise understanding of the links between patient health and contextual factors, such as where they live, work and play.
- **Indoor GIS** enables navigation in large covered areas such as stations and airports by relying on indoor systems such as Wi-Fi re-transmitters used to receive GPS satellite signals.
- **Passive GIS** syncs vast amount of spatial-related information from social networks with satellite generated location to enhance the location and user activity information.
- **Multi-source geofencing** provides spoof-proof user location and authentication by relying on multiple methods for verifying a user's location and identity.
- **'Internet of Things'** with a geo layer provides a vital link between the sensors that would generate the Uniform Resource Identifier (URI) assigned to a thing or an object.
- **GIS enabled intelligent infrastructure** helps create safer and more energy efficient infrastructure, especially in transportation and energy sector.
- **Open government geospatial data** including LiDAR (Light Detection and Ranging) and high-resolution aerial imagery is made available and consumable via APIs to power multiple applications.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Accurate location information and geospatial data helps governments design better cities, focus public services and engage with the public.

5G Rollout

- In Deloitte's 2018 Telecommunications Industry Outlook (https://bit.ly/2N10sKU) we discuss how 5G will be the connective tissue that blends nascent uses of mobile technology, such as the Internet of Things (IoT), autonomous vehicles, and mobile media, just to name a few. With the sheer number of applications that 5G will support, we anticipate a tremendous impact on the entire mobile ecosystem, as well as society and the economy overall - even bigger than 4G.
- 5G's higher frequencies have very short range which can be impacted by smallest of the obstructions. 5G will require a denser telecom network. To successfully plan the rollout of 5G requires understanding local conditions using geospatial data (e.g. height data, street furniture and vegetation density) to accurately model coverage.

Electric Vehicles (EV)

- A comprehensive network of car charging locations will be vital to ensure we are ready for EV uptake. These sites will be required at motorway service stations and other locations where vehicle owners can leave their vehicles with enough time to fully charge. Geospatial data and applications are crucial to supporting the identification and roll-out of EV charging locations.

Internet of Things (IoT)

- The physical world - living beings, assets, spaces/environment, supply networks - have historically been "unconnected" and therefore largely invisible to business leaders. The IoT enables breakthrough results by connecting the physical world to the digital world in innovative ways to enhance or generate new business value.
- The IoT has been driven through lower costs of electronics, pervasive communication networks and more accessible compute power, which has made previously non-viable business cases now viable.
- The IoT will bring a huge increase in data sources and the amount of data we need to make sense of to find insights. An increasing number of these will be spatially located which opens up more opportunities for the Geospatial sector for new applications, analytics platforms and services to make sense of all the new data.

Market Segmentation

- With all new technology, geospatial data and applications can be used a decision support tools to market more effectively and help forecast the demand for new services. Both targeting customers and predicting where and when growth will occur involves integrating business intelligence, demographic data and geospatial data to drive network investment and marketing campaigns.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

In Deloitte's white paper 'X no longer marks the spot: Transforming the public sector using geospatial insight' (https://bit.ly/1Tw0VWW) we discuss the four steps public sector organisations can take to increase efficiencies and improve effectiveness:

1. **Focus on efficiency**

- Almost all public sector organisations can generate cost savings from the smarter use of geospatial data to derive insights and inform everything from asset management to zoning requirements.
- Simply recording where assets lie, for example, not only informs decision makers of the availability of resources, but also allows more effective planning that translates to cost savings.

2. **Improve quality and performance**

- Geospatial data allows 'place' to be used as a basis for comparison. Creation of a common UK geospatial data infrastructure would aid collaboration and promote innovation by breaking down 'information silos' as well as organisational and cultural barriers. For example:
  - Ensure that common geospatial identifiers (e.g. the Ordnance Survey's Topographic Identifiers (TOIDs)) are 'tagged' (where possible) to geospatial data from across the public sector to make it easier to link datasets together and enable interoperability.
  - Publish data using a consistent geography e.g. property boundaries are important data to inform construction and planning decisions. Ensuring that public sector organisations that manage or enrich property data use a common boundary dataset.
- Visualise your data to identify new use cases, identify poor data quality and collaborate with other organisations to turn insights into action.

3. **Engage the public**

- Often 'putting data out there' can result in unintended consequences. The Department for Transport maintains the National Public Transport Access Node (NaPTAN) dataset, which details over 400,000 bus stops, stations and airports. When NaPTAN was released to OpenStreetMap by Traveline numerous volunteers among the public began to provide quality control, removing disused bus stops and updating access points that had been relocated. This example of crowdsourcing improvements to official data shows how citizens can turn private time into public value.
- The public sector needs to be open and transparent about the data that is collected and used, by giving the public an explicit choice to opt in, and by emphasising the personal benefits of such data use.

4. **Collaborate with other organisations**

- Collaboration between organisations promotes innovation and solutions to difficult problems in once sector may be found by people who approach a specific challenge from a different sectoral perspective.

- Remove internal information silos. Share technology, data and people across departments to fill holes in capability and insight.
- Encourage journalists, businesses and citizens to use your geospatial data and partner with the private sector where you can demonstrate that their specialist data is likely to contribute to more efficient or effective services.

Strong data governance

- All government departments should prepare to develop audit trails which track how data is used to ensure every interaction with personal data is auditable, transparent and secure.
- Building a Data Governance capability provides a holistic approach to ensuring structure, rigour and quality of data within an organisation. It includes both Master Data Management and Data Quality but also focuses on the strategy and organisational structure for its effective management within the context for the wider information management framework.
- Identifying ownership and accountability across the public sector organisation for data at the highest and lowest levels is key to success. Keeping the data 'house' in order has similar requirements to implementing an operating model or transformation strategy – the correct policies and procedures need to be put in place to ensure data can be trusted and relied upon for further analysis.
- The Commission could review/audit the geospatial data supplied by each partner agency, data formats, copyright and licensing and how often they are consumed/downloaded etc. This would allow the Commission to see the full spectrum of data formats that end users need to manage and manipulate in order to perform analysis.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Indoor Navigation

Deloitte's annual Technology, Media and Telecoms (TMT) Predictions reports (https://bit.ly/2FO5g43) are designed to provide insight into transformation and growth opportunities over the next one to five years. In our 2017 report we discussed the future of indoor navigation:

- Indoor GPS, which combines the power of GPS and precise mapping to indoor locations. This enables real-time tracking of location information on people or objects which can support location based marketing and customer interactions.
- By 2022, Deloitte predicts that at least a quarter of all uses of precision digital navigation will include an indoor element or be for an entirely indoor journey. This compares to less than five percent of all uses in 2017. Demand will be stimulated by sustained improvements in the accuracy of indoor navigation over the medium term, permitted by an array of positioning data, analytical

tools and high-quality indoor maps.

- Satellite-based digital navigation, accompanied by the digitization of street maps, has revolutionized how people and objects are located and guided. The fundamental blind spot of satellite-based digital navigation is that its signals, sent from 24,000 kilometres up, are often too weak to penetrate solid roofs by the time they reach the ground. Yet people spend over 90 percent of their time indoors; billions of objects, from vehicles to tools to components, all of which may need to be located, are housed somewhere under a roof.
- As of now, indoor location works in two ways: via Wi-Fi routers and cellular base stations. Over the medium term, beacons, LED lighting, ultra-wide broadband and magnetic fields are all potential additional sources of positioning data to add to the mix.
- An improvement in indoor positioning accuracy requires a commensurate increase in indoor mapping for its benefits to be exploited fully. There are likely to be multiple players that see significant benefit in generating indoor maps. Site owners are likely to regard indoor maps as a differentiator. A shopping mall could use indoor maps to enable people to find stores, departments and even aisles faster.
- Indoor navigation's potential is significant, and could be transformative. Private and government organisations should therefore be alert to the potential benefits from the availability of precise location data. And mobile operating system vendors should consider that consumers may choose their next smartphone partly based on the quality of indoor navigation available, and the apps available in each ecosystem that can exploit positional data.

Passenger Drones

- In Deloitte's report 'Elevating the future of mobility: Passenger drones and flying cars' (https://bit.ly/2DsaLI0), we discuss how**,** in a GPS-denied environment, these vehicles would need on-board sensors such as radar, optics, and geolocation sensors. While these technologies exist and are being utilised in autonomous cars, they would have to be improved to provide the longer-range sensing and recognition capabilities required to deal with the multidirectional and convergence speeds associated with autonomous flight.
- There would have to be a robust air traffic management system in place to guarantee safe and efficient operations of passenger drones and flying cars, which would meet aviation safety standards. To achieve this, industry leaders and manufacturers would likely need to reach an agreement on a reliable traffic management framework that integrates with other modes of transport, especially in urban areas. In the United States, there is already progress, with Uber and NASA recently signing a Space Act Agreement for traffic management of autonomous vehicles that will fly at a low altitude.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- The combination of public sector data and geospatial data collected outside

the public sector can contribute insights to decision making and policy formation. For example, anonymised location information from mobile phones can show patterns of movement across areas, which can be useful for a wide range of applications, such as traffic management, disaster response, crowd management, efficient allocation of public transport and urban planning.

- Most private agencies create and maintain rich value-added business centric geospatial datasets. Due to high cost in developing geospatial data, most of these data are remain private and not publicly accessible. Even though these geospatial data is mostly restricted, they are still required for enhancing the decision-making process. Companies selling geospatial data to public-sector bodies should ensure that their products are compatible with relevant APIs to overcome interoperability issues.
- In Deloitte's white paper 'Open Data: Driving growth, ingenuity and innovation' (https://bit.ly/1QyhXxr) we discuss how private sector organisations can help Government reveal underperformance and pinpoint inconsistencies by providing their data-related capabilities to analyse public data. Through this closer partnership, bad practices will be reduced and the best practices institutionalised through change programmes aiming at improving outcomes. As currently demonstrated in tax and welfare, businesses will also help government departments reduce error and increase detection rates for fraud through use of analytics.
- Private sector organisations could, for example, enrich their data with common public sector geospatial identifiers. This would ensure their customers can make full use of their data whilst enabling interoperability between organisations. In addition they could be made to adopt metadata standards to enable those working with public and private sector datasets to analyse them together.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- **A standardised way of storing and accessing geospatial data**, independently of the technology platforms and digital services that use them. We often need to source a variety of datasets from various public portals (e.g. NOMIS, ONS Geoportal, Ordnance Survey etc.) and considerable time is spent converting datasets to common formats (e.g. Esri Shapefile) or geocoding CSVs to plot them on a map.
- **Single download** functionality. Ordnance Survey's Open Zoomstack provides a single data file and via an API so the end user does not need to process 1,000's of individual data files. The file is also provided in easy-to-use formats to help you get started quickly.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Represent the wider community including other central government and local government organisations;
- Invest in learning about the day-to-day challenges to identify duplication of effort, pain points, and quick win opportunities;
- Reach out and collaborate with organisations working directly indirectly with geo data e.g. the ODI;
- Forge links with academia and the wealth of innovation coming out of Universities;
- Continue to work with and listen to established geospatial bodies in the UK and their membership e.g. The RGS and the AGI.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The commission should, where possible:

- Identify areas of overlap between strategies
- Preform a gap analysis
- Identify and agree common goals

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Gather and share success stories where geospatial data has been used in local public service delivery e.g. The Local Government Association's 'Geographic information case studies' website (https://bit.ly/2PbaJta).
- Local government should play an important role in the establishment of data standards and infrastructure. By giving local areas space to try and test data-sharing arrangements, it will help to demonstrate which projects are successful and could be scaled-up regionally and nationally.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- Promotion of events at a global level such as GEO business to showcase UK companies working in the geospatial industry.
- Continue to export the skills of Ordnance Survey via Ordnance Survey International (OSI) to help customers all over the world to develop and grow their geospatial capability.
- Promote businesses that sell geospatial products, analytics and software overseas to boost profiles, open up new markets and drive innovation and new partnerships.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- According to the recent GeoBuiz 2018 Report (https://bit.ly/2ySvL5t) the geospatial industry market is witnessing unprecedented growth in all geographies with high double-digit growth in the Asia Pacific, Middle East, Africa and South African regions, riding on demand from emerging market geographies.
- The overall engine of geospatial industry growth as well as its readiness to meet current and future leadership, however, remains with North America. This region will continue to maintain its market dominance riding on proactive initiatives to enhance commercialisation within the industry segments, (especially in the EO upstream value chain), and innovation led economic development model.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Direct Line Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instil best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The data types seem broadly appropriate as high-level definitions.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

(Not answered)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

(Not answered)

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

It is our belief that to fully realise the benefit of the Government's geospatial data, unrestricted access to geospatial datasets under an Open Government Licence (OGL) is required. This includes datasets such as MasterMap being made available without usage conditions. Ideally all geospatial data would be drawn from a centrally managed location and should be for the entire of the UK and not just individual parts of the country. Furthermore, data should be properly curated and maintained, and ideally would allow access to older versions of datasets. We believe that taking such an approach would benefit all geospatial users.

Currently, data is hosted across many different locations. This makes accessing open geospatial data inconvenient and adds additional processing time for users as well as preventing the discovery of new datasets that could add value. Websites, e.g. gov.uk, are generally not user friendly for users wishing to find new datasets. At present we tend to be made aware of publicly available geospatial data from informal conversations with people within the geospatial industry rather than through official Government channels. Moreover, datasets get updated at different frequencies whilst some do not get updated at all. This can reduce the overall use of such datasets as they are only useful for historical analysis and not for the identification and monitoring of present and future trends.

At present, users wanting only partial access to commercial datasets produced by Government bodies, e.g. Ordnance Survey (OS), are required to either licence the full dataset or use licensed partners to do geoprocessing on our behalf. This situation is not our preferred mechanism as it: reduces our ability to experiment with datasets, means that intellectual property is lost and adds additional cost to projects. These reasons can result in an inertia that prevents work being commissioned. If the Commission decides not to make datasets such as MasterMap fully accessible, we would request that the terms of access allowed of resellers and licensed partners are extended to larger corporations. This would allow users with an inhouse geospatial capability to use the data how they would wish to do so.

Data quality issues exist in several datasets. This includes information on flood defences where the condition of the defence, its maintenance, if it's been upgraded, as well as the standard order of protection, is either poorly maintained or not provided. Indeed, no flood defence information is available for commercial use over Scotland whilst in Northern Ireland such data must be licenced at a cost. Were this information properly curated and made freely available under the OGL, then it is likely a wider range of providers would be willing to offer insurance. This could lead to a reduction in their insurance premiums. It would also help insurers make better use of the Flood Re reinsurance scheme.

We feel there is also more that could be done within existing datasets. For instance, it would be beneficial if information was matched to a UPRN as standard for data at an address level. At present information such as Energy Performance Certificates or listed buildings data either has to be geocoded or geospatially processed. This adds time and reduces the size of the dataset as invariably not all addresses can be matched to a UPRN. Additionally, making 'clean' and 'raw' versions of datasets available e.g. LiDAR data would benefit all users and prevent

time being spent by multiple users in performing the same geoprocessing.

There are several additional public datasets that could be released as part of the Commission that would drive benefit for the insurance industry. These include: information on the presence of water and gas pipes; flood risk data, e.g. risk maps and historical footprints for Scotland and Northern Ireland; the release of Council Tax Band data as one file; the complete Land Registry dataset; and additional geospatial data from BGS e.g. GeoSure. Such datasets would assist the insurance industry in providing a more accurate price to customers, as well as helping validate our models. Again, the result of making such information available would be that it would allow insurers to provide a more accurate insurance price, which in turn could increase competition between insurers and result in lower insurance premiums.

Information that could be of use is not just limited to geospatial datasets but also courses run by, or with the support of, the Government. An example of such material are the modules from the Royal School of Military Survey's postgraduate Geospatial Intelligence course which could be released. Such material could help upskill geospatial professionals.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We feel that the Commission should work towards a national address gazetteer released under the OGL, with one unique reference number per address/property, including property coordinates. This has previously been discussed by a report commissioned by the Department for Business Innovation and Skills in 2014 entitled '*An Open National Address Gazetteer*'[1]. As a minimum we feel the current situation would be improved by having better alignment between UPRN and UDPRN.

Currently there are two main address databases, Royal Mail's PAF and the National Land and Property Gazetteer (NLPG) maintained by GeoPlace. PAF is more commonly used by business and websites in the private sector as this is the address that most customers recognise as well as it having a lower associated cost compared with AddressBase. However it does not include coordinates and is not authoritative like NLPG. Whilst most PAF addresses have been mapped into the NLPG by GeoPlace, hundreds-of-thousands of PAF addresses are unmapped and therefore insurers and other businesses cannot determine their exact location. This means that they cannot be assessed as accurately in geospatial analysis. In the most extreme examples this can reduce an individual's access to insurance e.g. when an address cannot be found on a website's drop-down list. In such an instance an insurer is likely to take a more cautious approach in pricing the risk as they may feel they cannot accurately assess the risk appropriately.

This could result in either declining to quote for a property, thereby reducing a customer's options, or opting to charge a higher premium as the full risk cannot be accurately assessed.

Another example of why this is important is with the Flood Re reinsurance scheme. In order to cede a customer to Flood Re an insurer needs the UPRN. Where there is not a match between UPRN and UDPRN a property is unlikely to be ceded to Flood Re. It is likely that such a property will generate a higher insurance premium and/or a reduced number of insurers will be willing to offer cover. Flood Re's own research from before the introduction of the scheme indicated that only 9% of customers who had made a previous flood claim could get a quote from two or more insurers, a number that changes to 100% after the introduction of Flood Re[2]. Addresses where there is no matching UPRN are likely to experience a pre-Flood Re insurance market.

Overall, we feel that having one version of addresses would therefore assist insurers and our customers, particularly those most vulnerable.

[1]*An Open National Address Gazetteer.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/274979/bis-14-513-open-national-address-gazetteer.pdf
[2]*Flood Re Our Vision: Securing a future of affordable flood insurance*. Available at: https://www.floodre.co.uk/wp-content/uploads/2018/07/Flood_Transition2018_AW.pdf

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The commission could look to enhance capability by making observation data readily accessible from one centralised, curated and maintained location under the OGL. Additionally, a series of ready-made products for users to download would be advantageous. An example of this would be vector-based daily flood footprints, attributed with a flood depth, over the UK. This could be produced via Sentinel data and would allow insurers to assess post-flood impacts more quickly. Were we to have access to such data, we could use it to identify customers within affected areas more quickly and provide faster assistance to them.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

(Not answered)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

(Not answered)

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

(Not answered)

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

(Not answered)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Geospatial businesses in the private sector should be encouraged to engage and support the public sector if they can add value above and beyond what the public sector can do themselves. However, we feel that the development and maintenance is likely to be best served within the public sector, with some mechanism for private sector users to be able to feed into the development and ongoing maintenance (see Q18). This is because we have experienced barriers in the past which we understand have come from within sections of the private sector, for instance, in the decision to close the OS GeoIntellingence unit.

One of the current issues for private sector organisations is that different levels of access to the Government's geospatial data is afforded to resellers and partners compared with end-users. This means that the final customer is required to either licence a full dataset directly or use the services of an official partner. Such a setup adds additional cost, layers of complexity, inefficiency and curtails research and innovative uses of the Government's geospatial data. In the most extreme situations this has resulted in us not carrying out work. A better solution than today would be for private sector end-users to have the same access and rights as licensed partners and resellers.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

In addition to having to licence certain datasets through approved partners and resellers, as discussed in Q4 and Q11, challenges tend to exist in a lack of centralisation, differing levels of data provision across different bodies and in data quality. Some examples of this include flood data. This data has to be accessed from separate websites for England and Wales, is not available for commercial use in Scotland and has to be purchased for commercial use in Northern Ireland. Such an approach means that this information cannot be taken into account when deriving flood risk for customers in Scotland, resulting in less accurate and likely increased prices for such customers.

A centralised location where users could access all of the UK's geospatial data, curated and maintained to the same standards, would make the data more accessible to new and existing users.

Regarding geospatial data formats, whilst there are some advantages in using web services and APIs, many users work in an offline environment where such services cannot be accessed. This makes some data types less useable. Further, whilst open standards are helpful, it would be beneficial to have multiple data types available particularly where they are used by a large majority of the sector e.g. Esri file geodatabase (gdb).

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

(Not answered)

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Government could drive additional benefit by using OpenStreetMap data as a complementary source to help attribute datasets such as AddressBase. At present, local authorities provide building attribution for UPRNs within AddressBase, yet the devolved nature of capturing this information means that data quality varies across the country. This prevents AddressBase from reaching its full potential e.g. being able to identify all of the *detached residential dwellings* across the country as attribution may be as simple as *residential*.

By using OpenStreetMap data, local authorities could enhance the dataset and populate more tertiary and quaternary codes. This richer dataset could assist in local planning and housing needs e.g. assessing the differences in requirements between areas of detached houses against an area of flats. A more fully populated dataset would also be of benefit to private sectors users.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

(Not answered)

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

(Not answered)

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We note that the Geospatial Commission are considering opening up components of the MasterMap dataset under the OGL. Whilst we welcome the Commission looking to make MasterMap available, in practice this would not help insurers if the intention is to apply a usage threshold. This is because it is the responsibility of insurers to provide cover for customers across the country. To do this effectively insurers would require unrestricted access to MasterMap in order to be able to apply the benefits to every customer equally. By fully opening up MasterMap, insurers would be able to give customers a more accurate insurance price, which in turn could increase competition between insurers and could result in lower insurance premiums. We feel it is important to make this point given that insurers are a group specifically named by the Commission in the call for evidence.

In the absence of making the complete dataset available, we would request that the Commission explores making the dataset available to the private sector under the same conditions as OS partners and resellers to remove one of the current blockers as indicated in our response to Q4 and Q11.

Q18: Are there any other areas that we should look at as a priority?

As an insurer, data is key to what we do. Not all data is going to be useful to us however. As such we would like the ability to directly engage and work with the Geospatial Commission to make sure that the public sector is aware of what would be beneficial to insurers as well as for us to be able to highlight where our problems exist. In its short existence the OS GeoIntelligence unit was such a collaborative space. Its closure was disappointing and felt to us a backwards step for the geospatial industry.

To improve this engagement and collaboration between the Geospatial Commission and the private sector we would request that there is some forum to allow communication between the Commission and the geospatial community. An example of where this might help includes the recent collaboration between OS and Microsoft in using artificial intelligence techniques to establish differences in roof types[3]. Despite the insurance sector being an obvious end customer for this data, such information has not been made available to the industry, which seems a lost opportunity.

[3]*Ordnance Survey used Microsoft AI to 'see' roofs - and it could save you money*. Available at: https://news.microsoft.com/en-gb/2018/02/15/ordnance-survey-used-microsoft-ai-see-roofs-save-money

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

(Not answered)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

(Not answered)

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

(Not answered)

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Cabinet Office consultation: Geospatial data

Company name:

Direct Marketing Association UK Limited (DMA)

About the DMA:

The DMA is the trade body for the data and marketing industry. We represent over 1,000 organisations – encompassing brands, agencies and marketing service companies.

Please visit our website www.dma.org.uk for more information about us.

Introduction:

The DMA welcomes the opportunity to respond to this consultation about the proposal for a UK geospatial data strategy. Geospatial data is increasingly used by the marketing sector to provide consumers with the offers about goods of interest to them, driving sales and economic growth.

The UK is already a world-leader when it comes to data and marketing, and so capitalising on the growth of geospatial data is a clear and lucrative opportunity for the UK economy as a whole.

Advertising and marketing are at the heart of the UK economy and play a vital role in driving economic growth. Annual UK exports of advertising services are worth £4.1 billion and every £1 spent on advertising returns £6 to the economy, resulting in £120 billion to UK GDP. It is the pioneering use of data that is increasingly driving value and boosting sales. The intelligent use of geospatial data could help a competitor gain an advantage, for example.

The report rightly identifies sales and marketing as a sector with the ability to drive growth in the future. Location-based marketing will help to deliver messages to consumers at the right time and to people who are interested in the marketing, cutting down on wastage.

The use of geospatial data in marketing

Marketers strive to form a single customer view, which is industry jargon for pulling together data from different marketing channels and different parts of the business, in order to better understand a customer and therefore create personalised marketing. For example, collating datasets from different sources. Combining data collected from someone while they were shopping in a physical shop with data collected from the same person when they purchased goods from the same business while they were online. Bringing together the two sets of data allows marketers to gain greater insights about the habits of their customers and make suitable offers in their marketing communications.

The availability of geospatial data is potentially the last link to complete a single customer view, as it connects the online and offline worlds. Potentially enabling marketers to more effectively allocate resources, and with a higher degree of accuracy offer people goods and services that they are highly likely to be interested in. This

would make organisations more efficient. Moreover, it would mean a slicker and smoother customer experience, cutting down marketing that is irrelevant or uninteresting.

For example, marketers could target people depending upon the activity they are taking part in, such as running or cycling. Someone might head out for a jog instead of going to their gym. However, the person's smartphone recognises that they're running using geospatial data. The gym then sends a push notification to that person's phone to advertise discounted health supplements. So long as the person knows that their gym will advertise to them in this way, then they will likely appreciate offers on goods relevant to activities they enjoy taking part in.

Location-based marketing

The ubiquity of smartphones means that most people are now broadcasting their location via their device and on a variety of different apps. The opportunity for marketers is to be able to personalise their marketing based on where somebody is at a particular time. Highly targeted messages that will hopefully be more relevant to consumers than more generic types of marketing.

Case study: Many mobile phone companies will now contact their customers when they know that they have entered an airport. They will offer their customers discounted rates for holiday packages such as a reduced price for data while abroad. The mobile phone company must ensure that they have a clear and unambiguous consent to send the SMS message to a consumer.

The mobile phone company case study is a clear example of the innovative use of geospatial data to deliver a valuable service. Consumers saved money by being reminded to sign up to travel offers before using their mobile phone while on holiday or travelling abroad.

Privacy and regulation

There are ever more devices generating data and collecting information about people, and with this proliferation of touchpoints comes a greater responsibility to treat data with the utmost care and consideration. Most importantly, organisations must ensure that they are upfront with their customers about how they process their personal data.

The DMA has been conducting research into consumer attitudes to privacy since 2012 and the latest version of the research 'Data privacy: What the consumer really thinks'[1] found that trust is the number one consideration for someone contemplating sharing personal data with a company, ahead of discounts and word of mouth.

The Information Commissioner's Office (ICO) recently launched a consultation into the creation of a regulatory sandbox[2] in October 2018. The sandbox would be a place where organisations could test innovative new products and services that use personal data while working with the ICO and drawing upon their expertise. The Commission should consider working with the ICO so companies can test innovative products that use geospatial data but also protect people's data protection rights.

Conclusion

The DMA would be happy to meet with the Commission once it has formed to help ensure that marketing maximises the potential uses of geospatial data in the UK.

If there are any questions arising from the DMA's response to this consultation, please do not hesitate to get in touch using the contact details below.

References

1. DMA: 'Data privacy: What the consumer really thinks' February 2018 https://dma.org.uk/research/data-privacy-what-the-consumer-really-thinks-1
2. ICO: 'ICO call for views on creating a regulatory sandbox' October 2018 https://ico.org.uk/about-the-ico/news-and-events/news-and-blogs/2018/09/ico-call-for-views-on-creating-a-regulatory-sandbox/

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	DJI
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

DJI's response to the Geospatial Commission's questionnaire

As the call for evidence document rightly states, "disruptive technologies, such as drones… will only be made possible by effective use of geospatial data". This is especially true as the technology advances, as GPS data is required for features such as position holding (maintaining position at fixed altitude and location); return to home capability; geo-fencing; obstacle avoidance; and autonomous flight. Concerning **Question 8**, therefore, high quality geospatial data can indeed support enhanced roll-out of drone technology, and drone manufacturers would certainly welcome increased access to public sector data to further boost the accuracy of these functions.

In relation to **Question 17**, drone route optimisation using geospatial data is already likely to become a priority for the UK Government and other European governments, as they seek to introduce the first elements of Unmanned Traffic Management (UTM) systems. Geospatial data will be critical for the success of these systems as it will determine where a drone is in relation to its flight plan, other vehicles in the air, and facilities on the ground. In fact, under new EU draft implementing regulation (Article 15), Member States may allow access only to drones equipped with geo-awareness systems when establishing geographical zones for safety, security, privacy or environmental reasons. Similar considerations will apply to the introduction of more advanced future of mobility applications, including autonomous air vehicles and delivery drones (as the Department for Transport's Science Advisory Council has been supporting).

In addition to drones being enabled by geospatial data, they are also an increasingly important source of the data. Drones provide aerially collected geospatial data (including information undetectable from the ground and on a much larger scale than terrestrial sources), but with greater versatility and cost-efficiency than conventional aircraft or satellite imagery. Drones can perform in adverse weather and on-demand for time sensitive issues, in a way that aircraft cannot, and provide much more precise data than satellite alternatives. A satellite image is usually accurate to more than a metre, while an image from a low altitude drone can be accurate to less than a centimetre. Photos or scans from drones are also tagged with GPS information that contains location and time markers. Given all of these advantages, it is expected that drone technology will continue to become more and more popular in geospatial data collection.

DJI is the world's largest manufacturer of civilian drones and aerial imaging technology, and therefore is highly invested in how drone technology can be both developed by more efficient geospatial data use and also enable further data collection. DJI thus hopes that it can help share its technical expertise with the new Geospatial Commission and be a part of the conversations feeding into the National Geospatial Strategy in 2019.

DJI would be particularly interested in working with the Commission to ensure that the regulatory environment is as supportive as possible of drone innovation and development, as per **Question 19**. DJI is committed to good, proportionate regulations that allow the drone industry to fulfil its potential and is therefore already working with policymakers in the UK (DfT, CAA, BEIS, MoJ) to share its cross-jurisdictional experience and technical expertise. The company would welcome the opportunity to engage with the new Commission once formed to collaborate on these aims.

Geospatial Commission Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:
geospatialcommission@cabinetoffice.gov.uk.
Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Dorset County Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

Geospatial Data - I would like to see something like "Information about objects where place is a key feature in relation to other objects around it, normally stored in raster or vector format".
Positional Data - This is normally considered to be "data that identifies the precise location of the device that collected Geospatial data. I'm not sure that I understand your definition in this context.
Geospatial Identifiers - A unique tag that connects an object to a geographic location.
Geospatial Services - Insights gained from utilising a variety of spatial techniques to analyse geospatial data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

Senior managers, particularly in local government do not understand the Geospatial revolution that is currently underway. Somehow, they need to be made aware/educated of the importance of Geospatial data and the teams needed to facilitate the best use of this data within local authorities. I'm sure this is true of other sectors. Location is being taken for granted as it is embedded in all our portable devices etc. But, senior managers are not investing adequately in Geospatial technologies, systems and personnel to embed location into all of the activities of a Local Authority/business.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There are many users of Geospatial data and systems, though many are unaware that they are using spatial data. Very few of these users understand, or even care, about how complex the spatial data is and the relationships between data sets and applications. The need in most local authorities is for specialists in Geospatial technologies. These include GIS, but perhaps more importantly, should include spatial databases, spatial data warehouses, spatial application development (web) and specialist management of these spatial resources. Geospatial is often hidden away within Local Government. It is time that it is recognised as an essential functional unit in its own right. This would then encourage a career path of recognised levels, Geospatial apprentice, GIS User, Geospatial Technicians, Spatial Database Administrator, Geospatial Developer, Geospatial Services Manager etc.

Q4. Are there any publicly or privately held geospatial datasets that are currently challenging to access or use, or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

All data is valuable. If it has a spatial component, then it becomes particularly valuable because it becomes much easier to look for relationships. Public Utility data is currently difficult to access except in an emergency, even then, it is often poor quality and very limited.
Local authority data is often difficult to access because of the perceived restrictions around its use, data protection, GDPR etc. Often, the only spatial element to data is the address, but all too often, this has been poorly constructed, is not to a standard (BS7666) and is difficult to match to a location. Simple standards are required to ensure that all bodies collecting data, particularly about the person, have an agreed spatial component. Better understanding of what and how data can be shared about the person would also help enormously.
Open by default should be our mantra, then look at what we need to do to protect the individual.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The issue is more about how the address is stored in relation to the information. Our addressing is excellent with a standard (BS7666). However, too many third-party software vendors/developers choose not to incorporate address database lookups into their applications. In an ideal world, we would store an address product such as AddressBase Premium in a single location with all our applications looking at it to create address information within the product if required. In reality this does not happen. Many applications cannot access external data so they either have their own internal address lookup or, more often, require the data inputter to manually enter the address. In our experience this results in about a 20% success rate when we then try to address match that data against AddressBase Premium. Open Access to Address APIs etc for application developers would assist along with a requirement to comply to standards.

Most emerging technologies want to make use of location data. We need to address the concerns around data protection to ensure that location is used appropriately without causing concern to the individual about their security and privacy.

Q6: How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

EO data can be very difficult for Local Authority users to consume. It tends to only be accessible to more specialist users. Therefore, to increase the use of existing data, it must be easy to consume without a great deal of translation/interpretation. Realistically, this probably means that several identifiable, and useful, products need to be created rather than simply raw data downloads.
Product types from a Local Authority perspective would be land use, light pollution, thermal footprints of communities/buildings, civil emergency response, pollution from plumes, wildfire outlines, flood outlines, natural habitat types, land change – afforestation, deforestation, landslip/rockfall, arable to pasture and vice versa, archaeological land use etc.
The impacts of climate change are often visible via EO so this technology could help to provide a valuable evidence base of climate change, drought, flood etc.

Q7. Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Communications infrastructure is already essential and our reliance on it is growing day by day. 5G networks are easy to obstruct at ground level with new buildings etc. The ability to monitor change in a near real time 3D environment would help plan and fine tune the delivery of such networks. Is it possible to visualise communications 'noise' via remote sensing? If so, then this may help identify dead spots in coverage.
Improvements to GPS and traffic movements will assist in many areas of industry, particularly the logistics of getting goods around the UK. Access to anonymised mobile device location data will help identify daily/hourly trends in population movement by road, rail and foot. This could help in the development of a truly integrated transport network.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

In simple terms, spatial analysis can identify over or under provision of existing technologies. If we use 5G as an example, should we aim for 100% land mass coverage or 100% population coverage? Should we favour personal communications over commercial uses? Should we use communications technologies to spread commercial wealth into impoverished rural communities? It will not be possible to roll out any future technologies without geospatial knowledge, data and applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The value of public sector data is if and how it is used. If it is not available, then it has no value. So open data is the way forward. For example, if BGS data is not available, or affordable, then both private and public sector bodies will look elsewhere for something that they can use within budget. The UK does have some of the best spatial data available anywhere in the world, but if it is not being used, then there is no point in the public sector continuing to invest. As much as possible must be open, particularly the unique identifiers such as UPRN, TOID etc. so that everybody can connect their data to the Geospatial Identifiers. It is the interoperability and connectivity of data that opens up its true value. The creation of open standards, for instance of Rights of Way in the UK would open up this public sector data to enable it to be shared. Most Local Authorities will provide their data as 'Open Data', but without a standard, its very difficult to use it consistently across the UK.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of in order to support the emerging requirements for geospatial data?

GPS is well established, but possibly under threat as global relationships deteriorate. The UK does not have its own GPS and probably has no desire to create one. IPS is still undefined and without a clear standard or specification. There is certainly a need to improve IPS, but this is probably best left to private industry as they will be the key beneficiaries. The public sector may have a role in developing geodetic networks to support IPS etc. but a clear standard is required.

The IPS is probably the area that requires most support now.

The public often remain confused about location data, GPS, NGR, WGS84, Lat Lon etc. are often alien to them and difficult to use. Emerging systems such as https://what3words.com/ could make location data more accessible, more social media friendly and truly global.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should work to standards such as OGC, INSPIRE etc. when creating new applications, updating applications or supplying spatial data. For instance, if an application has an address requirement, then it should be able to connect to external databases via ODBC to avoid the need to load an address gazetteer and should be able to utilise UPRNs etc. By utilising OGC standards such as GeoAPI 3.0, developers can standardise their client code incorporating methods for manipulating geographic information.
Private sector data providers can add value to data sets by incorporating Geospatial Identifiers if the Public Sector make them freely available.
The private sector could share more data for the public good in an open way; telephone box locations, cctv locations, public defibrillator locations etc.
To support the private sector a set of standards for publicly consumed data would be very helpful. For example, there are many providers of cctv, so to have a very simple standard for a cctv data set would ensure that thy could all be combined by the consuming organisation or a central industry hub.

Q12. Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish?

Local Authorities regularly face challenges when working with geospatial data. Licensing has improved but is still far too complex. Particularly around adding value and re-use of data.
Simple standards would help to make public data more useable. For instance, Local Authorities create a National Street Gazetteer from their own Local Street Gazetteer. This is achieved via the application of a national standard. We need more national standards, perhaps not as complicated as the NSG or NLPG, but a standard none the less. Certain data sets could be prioritised such as Public Rights of Way. Every Local Authority maintains PROW data, but each authority works to their own standard. If we wanted a UK view of our PROW it would be very difficult to achieve. With a national digital standard for PROW this could also be shared

with Ordnance Survey for inclusion in their maps. There are many other examples such as housing stock, development plans etc. where the application of a simple, national standard would make data shareable.
The provision of a data collaboration site to streamline how data is collected and provided would help. There are sites such as https://data.gov.uk/ allowing data to be uploaded however unless you are willing to search for all the uploaders you hit a wall. One solution would be to provide the standards for the dataset, let each contributor upload into the same dataset and then a complete set can be retrieved. Some form of validation would be needed, perhaps in the form of a user account. This would not only encourage Local Authorities to adopt the data standards but allow users from any area to obtain and use the data successfully.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Engage closely with the users and act as our broker to open up data. This should be two-way, data flowing to the Local Authorities, but also out of them. PURG is an effective communications channel between users and government, now via the Geospatial Commission. The continued process of opening up data to the public sector contracts (PSMA) is to be encouraged. BGS and Hydrographic Office data are useful to many Local Authorities but can be prohibitively expensive. Licensing needs to be simple and ideally all under one agreement across devolved administrations.
The recent addition of APGB is a good example of how this might work to incorporate private sector data. EO data could be included via a third party to add value, perhaps to enhance land cover or land use mapping.

Q14. Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Having access to good critical asset data would be very beneficial. For instance, utilities could provide the locations of sewerage treatment works, water pumping stations, telephone exchanges etc. The health sector could provide locations of critical care hospitals, or facilities that require good vehcle access at all times. The snow fall events in 2018 once again highlighted a need for this type of data. As a local authority we were being criticised because the utilities and health care professionals could not gain access to their critical assets, but they had never declared them as such, so they were not on our highway salting routes. Once declared, it was easy to resolve.
Utility distribution networks help local authorities determine things such as fuel poverty or lack of access to superfast broadband, mobile telephony etc.
We are all now familiar with systems such as Google's StreetView. This type of technology is being utilised by both the private and public sector to save time driving to locations. A similar approach could be taken for other assets that are not accessible by road, such as

National Parks, Public Rights of Way, beauty spots, tourist attractions etc. This could be achieved via social media. For example, imagine if you had a mobility difficulty, but were a massive Thomas Hardye fan. You lived a long way away but wanted to visit his birthplace. You can find a website that states it is available by foot only, either by following the paths through local woods or via an unmade track. Would you risk the journey on the off chance that you might be able to negotiate the track? If you had a website that provided route information supported by geotagged video footage, photos etc. you would at least be able to view the walk and make up your own mind. In some cases this may be available locally, but this could be coordinated to enable visitors to take 'virtual tours' of almost anywhere in the UK.

Question 15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The UK has many distinct regions and devolved governments. Particularly, the devolved governments have led to a number of different approaches being taken. In the absence of any single form of governance, the only way to achieve a consistent approach is via consensus. The UK Government and the devolved administrations need to agree on an overarching strategy and define a set of data sharing protocols and standards. For example, it clearly makes sense for addressing around the UK to have a common standard.
All consumers deserve equal rights of access to UK data so if there is a need for PSMA, OSMA etc. to satisfy the devolved administrations, then the documents should be the same in every respect bar the name. Scotland should have free access to English data and vice versa.
Regional variations should be limited to language options only and not impact on the data that is made available.

Q16: How can we best ensure effective Local Authority coordination and sharing of best practise, using location data to better deliver public services?

Ensuring strong user representation on groups such as PURG will assist greatly. Investment in strong local application of Geospatial best practice to help develop local practices into national applications.

In many cases there is a lack of understanding even within Local Authorities, so establishing 'Spatial Champions' could be a good starting point. People that could assist colleagues to understand how spatial data does, or could, benefit them. They could provide training or hold mini awareness seminars for colleagues.

This process could then be shared regionally via 'Regional Spatial Champions' (PURG regional reps) and then onto a National platform at PURG and other similar events.

Regular events such as the Regional PSMA Events or the annual AGI Conference are already used to showcase best practice. However, a better platform is required. It is difficult to get innovators within Local Authorities to showcase their work. However, financial support would attract their attention. Perhaps some form of Geospatial Innovation funding would be helpful? Geovation partly fills this need but is seen as very niche by the Geospatial community. A simple fund that is available via application would make innovators raise their heads above the parapet, where they can then be picked off to showcase their best practise.

As an example, at Dorset County Council we have developed a spatial application to help us meet our needs as a Lead Local Flood Authority, SWIM (Severe Weather Information Management). We searched the market and could not find anything that met our needs, so we developed the Web based solution in house. This attracted a good deal of attention nationally and the Environment Agency asked us to make an emergency deployment of SWIM available to Cumbria to assist with their flooding in 2015. From this Resilience Direct attempted to copy SWIM but failed. We have made it available to LLFAs in the South West and would require further investment to enable us to move it to the cloud and make it available Nationally. There is no incentive for us to do that, but if the funding was available as some form of grant, then we might apply for it and showcase our work.

Q17: As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **Property and land**
- **Infrastructure and construction**
- **Mobility**
- **Natural resources**
- **Sales and marketing**

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

Property and Land – In this paper, the phrase "location aware Insurance" has been used. Lead Local Flood Authorities have a duty to investigate flood events and report accordingly. This data is not currently shared with the insurance industry, but it could be. The key concern is that the sharing of this data may blight properties. However, the reality of not sharing it is that all properties in a given area (normally a postcode) are blighted because they fall within a certain distance of a

water course. Accurate information of properties that have flooded would actually enable insurance companies to review how they load insurance in a given area. Natural resources – This topic seems to focus on product derived industry, mining, farming etc. It needs to include the natural environment, recreation, natural habitat mapping, natural green spaces, Tourism related – rights of way, access to natural green space, river walks, mountain bike, heritage, food and drink etc.

Q18: Are there any other areas that we should look at as a priority?

Communications such as mobile telephony, superfast broadband, 4G/5G coverage, GPS, IPS etc. are important areas, but may fall into one of the other topics.

Support for Emergency Planners and the blue light services via rapid mapping services such as that provided by Copernicus. Will this be impacted by Brexit? Dorset County Council is working with the Met Office to create an API that will enable plume maps etc. to be incorporated into local systems via WMS. The UK is way behind the curve in its use of emergency hazard mapping, especially natural hazards such as Fire Danger Rating System (FDRS), live flooding, storm damage etc. Civil emergencies such as power outages, water supply disruption etc. are also difficult to map in a coordinated way. Hazard manager is spatially very poor, but it is a good starting point and could be improved.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The ongoing development of sustainable power such as turbines, solar farms etc. require careful spatial planning. Turbines can interfere with communications systems such as microwave and both turbines and solar farms can be intrusive in the landscape. Finding suitable sites is a spatial problem.

Equally, finding innovative solutions to distribute mobile telephony, 4G and 5G coverage will require a spatial approach.

New technologies such as autonomous vehicles and drones are still emerging. The tight geographic landscapes of the UK will pose problems that our international partners simply don't have. Whatever the requirements for these technologies are, the planning of networks etc. will require geospatial data/analysis. Autonomous vehicles and drones would require regulation and this will need to be refined and evolve as the technology changes.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Branding and marketing. The UK has some of the most respected mapping organisations in the world, but many UK residents don't recognise their acronyms or logos. Do we need a single, overarching identity 'UKGeo'?

Politically, the UK gets a mixed reception around the world, but our industries are generally well respected. We need to build on this and to invest in the overseas market, particularly where this adds value to UK Plc. For instance, if UK mapping standards were adopted internationally, then UK based companies would be a step ahead of some of their international competitors. Perhaps we should focus on the commonwealth and our most important trading partners (if we have any left post Brexit!).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

It is possible to access free official government mapping for most parts of the world via Web Map Services of one kind or another. This is more difficult in the UK. This is improving via the OS open mapping products and https://data.gov.uk/ but we still need to improve this.
Our privacy laws need to be sensible to enable the use of mapping, imagery and data without being too intrusive. For example; geotagged video or still images that show public places, street scenes etc. should not be unnecessarily controlled e.g. the need to obscure vehicle number plates or people's faces. People freely, openly and willingly display these in public every day. In some cases, it is even an offence not to. So why place barriers in the way of using this information? On the other hand, it is quite right that video or still images of private locations, gardens, the workplace etc. should be controlled. This also applies to the way that we share spatial data. The current GDPR climate has made people very wary of sharing any data, so clarity and common sense must be applied.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Earth-i
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definitions of geospatial data, positional data, and geospatial identifiers look OK. We would suggest that "geospatial *services*" should rather be "geospatial service *products*" i.e. the outputs of those services. Key to us is the inclusion of satellite Earth Observation data in its different forms, including very high resolution video and still imagery from satellites, but also extending to data from HAPS and drones and in-situ networks of sensors such as traffic monitoring and air quality sensors, or indeed any connected devices that include location information. The definition should also extend to geo-located information from social media, mobile devices, news feeds, weather forecasts, climate models and similar.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission should focus on inspiring the next generation of geospatial and Earth Observation data engineers and scientists. A programme of outreach into schools and universities to promote careers in this domain would be welcome, perhaps done in partnership with the UK Space Agency.

Sponsorship of postgraduate courses and programmes that enable STEM graduates to acquire specific geospatial and Earth Observation data handling and analysis skills would be valuable, as would sponsorship of industrial placements or apprenticeships in this field.

In particular, computer science graduates need to be skilled up in geospatial data processing, as many future apps will likely include a geospatial element; and in developing more user friendly interfaces to interact with geospatial data, to reduce the level of specialist skills and expertise needed in the end-user community to extract value from geospatial data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Earth-i has grown rapidly since its formation in 2015 and continues to do so. A key obstacle to our growth has been the availability of talented engineers and scientists with relevant geospatial data analysis skills. Such recruits require exposure to appropriate ICT skills as well.

We have a constant need for talented STEM graduates in these areas:

- Geospatial data scientists with Python geospatial data processing skills
- Geographical information system (GIS) experts
- Earth Observation data analysts with machine learning and artificial intelligence skills and understanding
- Earth Observation data processing engineers with skills in modern data processing such as data stream and machine learning approaches
- Data scientists with an understanding of geospatial data structures and formats, and approaches to big data processing

It is essential to excite and inspire the next generation of engineers and scientists to choose a career working with satellite Earth Observation and geospatial data. We expect Earth-i's forthcoming constellation of British high-resolution video satellites to generate a significant buzz and media interest that can be used to inspire and promote careers in this domain.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Earth-i works with very high resolution still and video satellite Earth Observation data to deliver analytics and insights to our customers. The full value of this data is often realised when analysed in conjunction with complementary public or private geospatial data sets. It is therefore essential for our business to have operational access to geolocated data including free and open satellite data, mapping data, weather data, social media, news feeds and more.

The UK lacks a coordinated data access solution that can bring together commercial and public geospatial data sets and make them easily accessible to companies like ours. The UK space agency has tried to enable access to Copernicus Sentinel data via the SEDAS hub, but this is just one element and has limitations. STFC invests separately in the JASMIN facility which is predominantly for NERC use. We would prefer to see the UK take a more holistic approach rather than investing piecemeal in disparate elements of a solution.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

This would not be a priority for Earth-i. We do not make extensive use of address data in our services currently, although this may change in the future as we develop new services, e.g. for the insurance sector. So, we are not currently aware of any necessary changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

As per Q4, we would welcome a holistic approach to geospatial data access for the UK, which would bring together diverse satellite and terrestrial geospatial data sets along with the necessary storage and processing capacity, the tools to exploit the data, access to expertise and know-how, and the means to deliver resulting services to customers in the commercial and government sectors. These efforts should be joined up across the Geospatial Commission, the UK Space Agency (which is examining options for UK EO Data Access), and the ISCF Wave 3 "Space Data Revolution" challenge proposal, to enable an effective market.

Another key role for the commission would be to organise and coordinate the UK government's needs for geospatial information – essentially acting as 'intelligent customer' for geospatial information services on behalf of the UK government. This would enable industry to act as an 'intelligent supplier', investing in key areas to meet government needs. If geospatial services can be operationally proven at significant scale with UK government users, UK industry will be well placed to export similar services to governmental and commercial customers globally.

There is also a need to address the applicability of EO in support of Defence. While this sector undoubtedly has access to an indigenous capability, there is much that could be done to leverage the commercial sector to add value.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

If the UK continues to rely upon free and open data sources provided by Europe or other countries, we will never differentiate ourselves from any other nation vying for economic growth in this domain.

We see the biggest potential for economic growth coming from the exploitation of near-real-time, very high resolution, global data which can unlock the insights that help business and governments to make better, more timely decisions.

As such, we would encourage the commission to support the growth and evolution of the UK's capability to provide and exploit its own very high resolution, near-real-time geospatial data sources, in particular focusing on technologies that give the UK a unique proposition – such as satellite video constellations, small radar constellations, thermal infrared sensors, and other evolving technologies that build on UK industrial and research strengths and can differentiate us.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

There are many ways in which geospatial data supports technology roll-out. Examples are found in infrastructure such as the planning of high-speed rail, from the location of stations to assessing catchment areas. It is used for the validation of demographics, population for a product, measuring footfall. Surprisingly, 3D mapping has only recently started to be used in construction.

There are other examples in areas such as in agriculture, transport, energy, conservation of natural resources, and responding to natural disasters, and there are many new applications of geospatial data that are yet to be conceived. In all cases, use of various types of Earth Observation allow such applications to come to fruition faster and with global applicability, particularly where other data is not available.

Therefore, in order to support enhanced roll-out of future technologies, it is essential to make it easy for industry and researchers to access geospatial data and apply it in new areas of government and commerce. It is also essential to invest in R&D of new applications and support the transition of that R&D into successful demonstrations and onwards to commercial applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Many public sector organisations in the UK invest in their own infrastructure to maintain their geospatial data sets. This includes commission partner bodies (UKHO, BGS, OS etc.) as well as others such as the Met Office, STFC, Defra, several universities, NERC research centres (such as BAS and NOC) and the Satellite Applications Catapult, for Earth Observation data.

This approach tends to result in ‘stovepipes’ of geospatial data dispersed around the country with a variety of formats, standards, accessibility, licensing etc. The UK open data policy mandates public sector organisations to make all non-personal data available openly but each organisation is at a different stage of implementing this policy and it is particularly challenging for industry to access or even discover what data is available and where. It also makes it difficult for all UK stakeholders (public and private) to exploit the synergies between these data sets.

Our preferred option would be for the commission to lead the way in establishing a common national repository for geospatial data in which most if not all UK public sector organisations would be able to participate, adopting common standards, formats and interfaces. This need not necessarily mean a common physical infrastructure; elements of the repository could still be hosted by different organisations, with focus on enabling interoperability and a common point and means of access for al UK stakeholders, public and private.

The UK has, to our knowledge, no organic Earth Observation capability to support defence, security and intelligence. There is much that could be done in partnership between industry and these sectors to enhance overall UK capabilities. Policy appears to be lacking in this area.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

This is not our particular area of expertise.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We are strongly in favour of the UK public sector sourcing as much as possible of the development and maintenance of the underpinning infrastructure from the private sector, as long as there are checks and safeguards in place to ensure that this infrastructure is made accessible to all UK stakeholders on a fair and equitable basis. If the capability exists in the private sector, it does not make sense to duplicate this capability in the public sector.

A vibrant private geospatial sector, made more successful by engaging more comprehensively with government as a customer, will inevitably enhance the UK's overall geospatial data assets and exploitation capability.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Please see also our response to Q4 and Q9.

SMEs and large organisations have real issues navigating and negotiating data access, even for publicly purchased or provided datasets. Even data.gov.uk lists many datasets that cannot be systematically accessed. Public and private organisations need to be required and/or incentivised to make data public where possible, adopting appropriate interoperability standards to ensure data can be easily located, interpreted and exploited by industry, research and government users.

There appears to be very limited policy or guidelines for commercial interaction with the public defence, security and intelligence sectors. The Geospatial Commission could play a pivotal role in developing these.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

See also our response to Q6 and Q12. Essentially, this involves:

- Identifying current and future geospatial data requirements across all relevant government departments and agencies;
- Consolidating these and identifying areas of duplication or overlap, so that relevant geospatial data can be acquired once and used multiple times;
- Making the needs and requirements openly visible to industry, such that industry can plan its own investment and technology development to meet future public sector needs;
- Act as coordinating procurement agency on behalf of government, tendering for 'geospatial information as a service' with decent length contracts (e.g. 3-5 years) and associated service level criteria;
- Ensure level playing field for large and small companies to respond to these procurements and engage multiple providers to ensure quality, diversity and resilience of data supply.

This type of sophisticated approach would ensure value for money for UK government when procuring geospatial data/information services, whilst also encouraging UK industry to invest and ensure continuity of supply for future government needs.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Commercial datasets for proving and scaling services that would be useful include twitter feeds, mobile data feeds, transport sector data feeds (shipping, road, rail, air), meteorological and mapping data, etc. Gaining access to these on a centralised basis, with permission to use for service demonstration, would be beneficial for big data applications.

In many cases this is of interest to private companies where the data does not infringe personal privacy. An arrangement to provide unfettered access to prove applications followed by an agreed process to negotiate ongoing access to a subset of that in the case of product success could be negotiated centrally by an organisation such as one of the Catapults. These would make a range of useful datasets available to industry to build applications, with a route to commercial implementation and exploitation.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The Geospatial Commission should focus on setting a high level vision and ambition for the UK as a whole to achieve and benefit from superiority in geospatial data and information management and exploitation. As stated already, this vision and ambition should clearly include Earth Observation data and resulting information products within its remit.

If this were to be done well the national, regional and local authorities across the UK would be able to ensure that their own individual strategies, despite necessary variations, contribute towards delivering the overall vision.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The key challenges here are (a) the lack of a clear and consistent set of standards and mechanisms for local authorities and other public sector organisations in the UK to record and share information regarding their services, and (b) the lack of any clear (centrally driven) incentives for them to do so. Leadership from the Geospatial Commission in this area will help to promote openness and sharing across these organisations.

Measures that are likely to help include:

- Develop common standards for all local authorities to adopt;
- Provide training and upskilling/reskilling amongst local authority users;
- Provide access to low-cost geospatial software tools;
- Develop a national geospatial data access mechanism (as per Q9) that local authorities are able to access and contribute to;
- Develop national geospatial data quality benchmarks/standards
- Establish special interest groups for knowledge sharing
- Share information and best practice through conferences / working groups

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

This question has significant overlap with Earth-i's own commercial business plan, as we are currently developing analytics and insights services in all of the above areas, as well as other sectors such as financial services.

Here are just a few (non-exhaustive) examples in each of the above areas:

Property and land: Monitoring land use and land use change; managing forests and woodlands; supporting the agri-tech and food industries; identifying suitable sites for construction, development, renewable energy generation, etc;

Infrastructure and Construction: Detailed surveys and 3D mapping of construction sites; monitoring progress of infrastructure/construction projects;

Mobility: Accurate 3D mapping of road infrastructure to enable autonomous vehicles; monitoring of traffic and congestion; monitoring air quality; monitoring transport infrastructures and their interactions through 'patterns of life';

Natural Resources: Monitoring ecosystems and habitats for wildlife; monitoring and protecting water resources; monitoring of mining, logging, etc;

Sales and Marketing: Use of satellite and other geospatial data for promotional activities around events; integrating with social media feeds; news and media; demographics and population catchment.

Q18: Are there any other areas that we should look at as a priority?

We would like to see remote sensing and Earth Observation focused on as a priority area for the Geospatial Commission. As data analytics and applications that integrate satellite, drones, high altitude platforms and other data emerge and evolve, along with complementing technologies such as artificial intelligence, computer vision and machine learning, the Geospatial Commission should ensure that these vital capabilities (in which the UK has excellent heritage) are clearly embedded within the national geospatial strategy. Remote sensing has numerous applications across government in helping to deliver policy priorities and monitor effectiveness of these policies; and any services developed in the UK to meet national requirements are readily exploitable commercially in export markets.

We would like to see the Geospatial Commission work across UK Government to ensure there is support for private sector initiatives that put the UK at the forefront of the geospatial services domain. The Earth-i constellation of high-resolution full-colour video satellites sits firmly in the class of enabling technologies that would give the UK a unique proposition for domestic and export services and help to

showcase British capability in the international geospatial services arena. Home market Government support for such large and technically challenging initiatives can be a vital element of their success.

As per previous answers, enabling the commercial sector to work more closely with defence, security and intelligence organisations on earth-observation would be extremely helpful in meeting national security requirements.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are many potential public and private sector innovations that could be catalysed by improved access to relevant geospatial data, including very many that haven't even been thought of yet. A few that Earth-i is already pursuing are listed below, but there are numerous other examples:

- Using artificial intelligence, computer vision and machine learning to extract useful information from EO data for end-users in government, commercial and security/defence sectors to inform better decision making;

- Combining very high resolution satellite EO data with terrestrial geospatial data to provide commodities and global supply chain information to the financial services sector and relevant large scale raw material consumers;

- Combining very high resolution satellite EO data with mapping data and terrestrial infrastructure data to assist utility companies to manage their assets. This includes identifying potential underground leaks in major parts of the UK's water pipe network by studying vegetation at the surface.

- Combining VHR satellite EO data with localised digital elevation data and localised weather data to assist smallholder farmers improve crop yield and quality, thereby enhancing their own economic performance, which leads to associated socio-economic benefits such as raising education levels, etc.;

Potential regulatory challenges include:

- regulation around the use of HAPS, drones, autonomous vehicles and other aerial or terrestrial platforms to collect geospatial data;
- privacy issues including confidentiality and security of geospatial data that may allow individuals to be identified;
- regulation around the launch and operations of UK-owned commercial satellite constellations;
- export controls and negotiation of international trade agreements.

In the context of Brexit, the UK needs to ensure that adequate support is given to export initiatives through high value campaigns, trade missions, and promotion of UK geospatial capability in the international arena.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK urgently requires a joined-up national approach to collecting, storing, sharing, disseminating and exploiting global geospatial data sets, that addresses the needs of UK stakeholders across industry, research, academia & government. The commission is uniquely placed and funded to make this happen, working closely with the other key initiatives, notably the UK Space Agency's efforts to provide robust and operational EO data access for the UK, the ISCF Wave 3 "Space Data Revolution" proposal, and the Space Sector Deal.

With a coherent and well-coordinated national approach and strategy, UK capability and services will speak for themselves in the international geospatial world. There are also several international fora where the Geospatial Commission can actively promote UK capability – for example CEOS, UN-GGIM, GEO or the International Charter for Space and Natural Disasters – working closely with UKSA, Defra and other relevant UK bodies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The European Copernicus DIAS platforms are rapidly becoming centres of gravity for hosting EO and non-EO geospatial data in Europe, along with relevant tools, storage and processing capacity to exploit the data, and e-Commerce facilities.

Australia has invested significantly in its open data cube implementation. Some states like Queensland are routinely procuring state-wide high resolution coverage on an annual basis and making it available through flexible licensing arrangements to support its public services.

France and Germany have invested significantly in national EO data centres (PEPS and CODE-DE respectively). The Netherlands is routinely purchasing satellite data coverages of the country, as well as collecting Sentinel 1 and 2 data, and making raw and pre-processed ARD freely and openly accessible to Dutch users from government and industry.

In terms of geospatial big data implementation, North America is leading the way. The USA has established a national geospatial platform (www.geoplatform.gov) and Canada is establishing its own Federal Geospatial Platform. In the private sector, North American organisations such as Amazon, Google, Planet, Maxar/DigitalGlobe, BlackSky, Orbital Insight, Descartes Labs, Urthecast and others are investing heavily in this domain, recognising the commercial potential.

Thank you for your time in completing your response to our call for evidence.

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Geospatial Commission: Call For Evidence Response Questionnaire

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	East Hampshire District Council Havant Borough Council and Hart District Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	

Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The 6 partner bodies, whilst holding some of the core spatial datasets, other data such as: - Space captured imagery seems to be overlooked. With this the critical temporal data that must be contained within all areas of Location data.

In general, I agree with the general context that is defined as geospatial data. And the data that supports this.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Development of common data standards across GB. And with that **a statutory duty to provide data to those standards.**

Provision of a single point for data delivery across GB.

Alignment of contributing organisations i.e. Local Government a primary data creator and holder of statutory spatial data via standards or transformation tools to create generic format datasets. Into recognised open data standards.

i.e. geopackage.

The inspire data holdings are not fit for purpose.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

I'm in a fortunate position to have a fully resources team, with extensive knowledge and market leading solutions.

Many LAs have suffered a haemorrhaging of highly skilled practitioners.

Professional Geographers are already well catered for as far as it goes for professional support.

As a Fellow of the Royal Geographic Society, I'm aware of career support.

The real issue is to attract highly proficient technical staff i.e. coders and web developers into the sector.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Thames water network.

Used within Building Control, Planning and Searches
Highways extents as above

Access would be good, via WFS and WMS would be great.

All other public data held in a generic format with common data standards for easy access and a single view of the truth.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Possible integration with voice recognition technologies i.e. Alexa and Cortana

I.e. ask a web enabled devices spatial questions. Where is my nearest hospital? (Address) How quickly can I get there (Network)

Removal of PAF element of address data (government buy out of the POST CODE) to enable free to use data across gov and commercial users.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Not currently using this data. But any form of environmental monitoring, the ability to detect real world change and inform policy makers would be extremely useful.

Remote sensing raster classification to common standards would be great

In line with national vegetation standards, so standard classification across imagery like built environment would be a good start.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Standard national data catalogues.

Common attributes across all Local Authorities

WMS and WFS feeds

APIs

GEOpackages

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Real time feeds of environmental changes.

Real time transport infrastructure monitoring and reporting.

Integrations with the spoken word.

Future Technologies? What is next?

Current use of available technologies across the public sector is not consistent

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sectors organisations that are not national operate in a silo model. Setting PAN Government standards will break down those silos, and free the existing rich geospatial data to be used for the greater good of the economy and government.

The public sector has been squeezed to the limit and resources are being lost from data creators. If we don't have the data to sufficiently exacting standards it becomes value less.

By ensuring that data creators build mechanisms to use common standards we free that data and ensure that it has the attribution that is useful across the sector.

Make the standards statutory will go a long way to protect these vital data creators.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Development of highly accurate GPS to mm level and use of Lat Long WGS84 within all data sets to enable outside UK developers to make the best use of data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Key utility data sets to be easily available that are maintained by the Private Sector

Electricity
Water (Supply and Waste)
Gas
Hydrographic data (Not private sector but not easily accessible)

Ensuring that commercial sector develops tools that can build and deliver geospatial data to a universal standard.

Provide expertise to UK public sector on emerging technologies.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As previously stated technologies are already available to create single versions of the truth.

FME being the market leader for transformation and repurposing data.

Single repository for UK data like the inspire DATA.gov could be created to data creators.

Schedulers from back office applications could auto send data sets into this repository nightly from all LAs and republished as a single national dataset. That is temporally accurate.

This can only be achieved if all data creators adopted this model.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The current structure works well. The main value the commission could bring is to provide a legal structure to data creators and users.

The inspire directive is not fit for UK PLC as it is almost impossible to join data sets together in a meaningful way.

The PSMA works well for all its members, but wider direction is required, with more teeth to get the valuable geospatial data created for the public good

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Hydrographic Data

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

As previously mentioned, common data standards can allow for this.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

As previously mentioned, common data standards can allow for this.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Local Government

Local Plan Data (Policy) a **policy engine.** This would be the single most beneficial dataset that could create huge efficiencies across GOV and the private sector.

Beneficiaries would include

- LAs
- Developers (Housing) Big and small
- Citizens
- Policy Makers
- Insurance
- Financial
- Environmental
- National Parks

This would meet all the key area

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

Q18: Are there any other areas that we should look at as a priority?

Education

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

From previous question

Local Plan Data (Policy) a **policy engine.** This would be the single most beneficial dataset that could create huge efficiencies across GOV and the private sector.

Not currently a requirement from the public sector. (Inspire cannot deliver this)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

If we adopt common data standards across the public sector and write that into the statute book. As far as I'm concerned this will create geospatial information and can be interrogated across all geographies, so you are using geography to break down geography. Seamless uk datasets for LAs will make the UK the leading user of geospatial data.

Sell this concept internationally and were there!!!!!

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No similar models have been built.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	East Riding of Yorkshire Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Definition seems sound.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

How are school curriculums directed for the integration of cartography and data representation?
Is this an avenue that could be explored to garner interest/understanding early?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There is a need for existing datasets to be reviewed and updated. A great deal of useful existing datasets are becoming less relevant due to requiring an update. Such an example include 'The National Receptor Dataset' (EA, 2011).

Private businesses that operate and create infrastructure that serve the public (gas, elec, water utilities) could publish a list of the geospatial (and modelling) data they have, this transparency would allow dialogue between organisations to be opened to align objectives and deliver greater outcomes.

There is often duplication of work in terms of surveying and data collection,

something could potentially be done to map where survey works have been undertaken with the possibility of opening dialogue share/access data.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data is import in the context of flooding risk for identifying properties at risk.
Being able to identify the property use is often a key attribute, not only identifying the BLPU (Basic Land and Property Unit, as found in Local Land and Property Gazetteers (LLPGs)), but also drilling down to specific use with the industry but be extremely useful for identifying and quantifying benefits of flood schemes to commercial areas.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Geo-physical data, land use (based on condition of the land and seeking to make it useful in some way), flood risk.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Identify local needs and how to capture that data, whether through new bespoke datasets or enhancing existing datasets.

Central Government could provide templates to ensure consistent data collection attributes are consistent across Local Authorities and then combine them to create national datasets.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Greater transparency and data sharing. There's probably a lot of duplication of work between public and private sectors. This could potentially be minimised by greater co-operation and licensing.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Issues mainly revolve around datasets not being up to date.

Consult with data users on specific datasets to determine what they are wanting the data for and how it can be managed to facilitate the desired outcomes.

Any value in engaging with other data holders/encouraging works to improve datasets at a local level, which can used to update the dataset nationally.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Access to data relating to geo-physical datasets, these would help in early phases of determining viability of flood schemes.

Access to data relating to ecological, these would help in early phases of determining viability of flood schemes.

Land use information, tools to determine numbers of jobs in an area, geo-spatial SME data, agricultural outputs.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Share datasets, common attributes captured for datasets

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Sustainability though management of flood risk. Land use and planning ensuring that business can deliver their services/products effectively.

Q18: Are there any other areas that we should look at as a priority?

Flood risk/climate change

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Elaine Ball Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
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Other - please state	

Call for evidence - three key themes

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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Firstly you can't have a vibrant infrastructure without geospatial information.

People don't understand the disciplines involved in geospatial. Image processing, guidance and navigation etc etc.. in the context of geospatial sciences. It should be our objective to interest children at an earlier age to understand about the geospatial subject.

Kids have no idea what a 'surveyor is' or that 'lasers' measure distances! This is now showing as at universities the numbers of teenages going into subjects related to "Geospatial" are significantly dwindling.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

1. Starting with kids under the age of 12.
2. Educating teachers on the geospatial subjects tied into the curriculum like what Alison Watson at Class of your own' is doing. https://designengineerconstruct.com/
3. Practical classes on cartography in geography

4. Science subjects should encompass subjects involving; AI, Augmented Realisty http://geoawesomeness.com/augmented-reality-geospatial-technology/

4. The Gov should train teachers or careers advisors in these subjects by either hiring from the Geospatial Industry or getting these teachers exposed to the industry.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Surveyors. While technology is innovative – the lack of special 'survey' skills is noticeable with my clients and not just in the UK. This is due to kids not knowing about the industry and therefore not picking the subject. The brand perception is 'old fashioned' but the 'realisation' is it's very innovative like AI, AR, Mobile Mapping, UAV and other technology. The Gov must educate people from a younger age.

We need to intertwine 'geography' and 'science' subjects with skills sets that are practical and excit kids. Exposure of the industry is key for example; kids and many adults have no idea that explosive manufacturers use 'survey skills' to monitor the boreholes and rock face geometry in quarries and mines, in order to know how much explosive to use, or that special 'mine surveyors' use tools to find and monitor the position of voids.

I have launched a campaign called #GetKidsintoSurvey www.getkidsintosurvey.com which focuses on 'brand exposure' and building 'awareness' of the geospatial industry globally. This has taken off to the extent that surveyors are desperate for interactive creative content that **excites kids** – we are shipping posters globally, which has exposed the global problem and we have only scratched the surface. 2019 we plan to launch knowledge HUB for schools, teachers, parents, surveyors, media and kids. A focal point which then takes the viewer to places that are linked together. Thus educating them in the subjects.

See copy of the posters here;

https://www.dropbox.com/s/53qq9sqbiosty1b/Civil-Engineering-Poster.pdf?dl=0

https://www.dropbox.com/s/ex4vrri56p6iaw4/Forestry-Poster.pdf?dl=0

For long term growth; we need to educate the youngsters.

For promotion; we need a national strategic marketing plan which ties the industry together – this is what we plan to launch at Geobusiness 2019 (May)

The Gov must do this through educational content and making sure sources like us are liaised with in order for all of us to be on the same page.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There are many reports by multinationals and research companies but to access them you have to pay ££££s which is unrealistic to most survey, schools and small companies. For example; the growth in the LiDAR industry is $4k+ to purchase https://www.grandviewresearch.com/industry-analysis/lidar-light-detection-and-ranging-market

https://www.mordorintelligence.com/industry-reports/lidar-market

While these reports would be extremely useful the price tag is ridiculous – so companies have to go elsewhere to find information.

People would purchase reports if they were say in the hundreds vs thousands. I'd like to add that I appreciate the research time but the cost is crazy.

There is also a lack of trust that these reports will bear good meat vs nothing on the bones – I don't know any company who has purchased these reports and I work with companies like Trimble, Leica, etc (who are in the billions! – that says something ah)

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Relaxed and or updated regulations about using cloud storage. Giving the industry an easier route to access and store data in the cloud, will have significant benefits.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The commission should acquire geospatial data for public data access. Ie. We can map the entire UK and the market would find uses for it. Think Google Earth.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Mobile mapping and UAV technology for sure. Companies like Leica and Trimble launch new lower cost mobile mapping systems ie. Leica Pegasus2 so smaller survey companies can map streets.

Standardising mobile mapping for any type of road or rail corridor work should be given thus all parties pitching are on a level playing field and the data produced is very similar. Mobile Mapping technology is safer, faster and much more cost effective due to speed. UAV technology has its uses esp from a safety point of view. Adopting better performing technology esp now with lower end systems will be better for the development of economic growth.

Data storage of the petabytes of data produced by laser scanners needs to be utilised. A cloud-map of data can be reused by multiple organisations from the local council to the BT man. Something TopoDOT in Florida are pursuing. This is very advanced in US compared to UK.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Data developed by say mobile mapping technology = petabytes of data
- First to handle this data (opportunity 1)
- Data is knowledge ie. Map London = 3D streets everywhere at 1cm accuracy
- Data is stored on cloud
- Data can be used and re-used to develop intelligence at a later data for example; you survey a bridge for the structure but later on you wish to resurface it and need to access the data again to know the sizes in mm's.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Relaxing restrictions on storing data in the cloud. Its extremeley expensive
- Allowing more public access through the public cloud
- Standardising

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Public cloud storage networks. We need to pull back on restrictions.

Keep open minded and see what's trending through people in the industry. Going to key shows over and over again, you soon see what is working and what isn't.

- **Indoor technology like Trimble Sketchup, GeoSLAM and Microsoft Hololens are crucial innovative technology for enhanced geospatial data like sizes of rooms, safety etc Even if they don't make it, they create new ideas and ways of doing stuff!**
- **Mobile Mapping for quick and safe data collection of our road and rail corridors = faster = more accurate data**
- **Data Storage = how to handle the data. The more accurate these laser scanners get, the more data is being produced.**

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- The private sector relies on data storage sharing for greater access, speed, ROI and improving information sharing
- Facilitating the use of public low cost data storage when possible
- Work with UK companies to develop this for the UK

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Yes
- Restrictive
- Expensive

As above

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

As above answers

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- Work with an array of geospatial organisation who are aligned around a common goal
- Tie in goverment organisations and boides like RICS
- Tie in educational institutions
- Have regular meetings to showcase mission
- Market to develop learning, sharing and focus

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Educate them like a business focused on ROI and a long term strategy
Make sure they are tied to a common vision and mission

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
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- **mobility**
- **natural resources**

- **sales and marketing**

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Q20: How best can we make the UK's presence in the international geospatial world more visible?

Geobsuiness in London are doing an exceptional job at pushing Geobusiness show which is very well attended.

https://www.geobusinessshow.com/ This is well marketed and well attended by companies outside the UK.

A global committee needs to be set up with key people from different areas of the profession ie. Education, survey companies, large survey organisations, large construction companies, show people etc... so you get a varied outlook.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

NSPS in USA – they are responsible for state survey associations https://www.nsps.us.com/ - [Text redacted]

Look at groups and comment trends voiced ie. Laser Scanning Forum – technology focused form based on Laser Scanning https://www.laserscanningforum.com/ [Text redacted]

International Federation of Surveyors http://www.fig.net/ [Text redacted]

Facbook groups like Land Surveyors United https://www.facebook.com/landsurveyorsunited/ [Text redacted]

SPAR https://www.spar3d.com/ - Conference

ILMF and MAPPS https://www.lidarmap.org/ - Conference

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Elmbridge Borough Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial Data and Positional data terminology is confusing think there is capacity to simplify and consider all data as one, not sure of the benefit of splitting it out.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Data science Data analysis Process automation Technical skills and knowledge of new devices that are driving industry changes Skills & solution sharing across organisations

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Data science
Advanced Data analysis skills, database & data management (non spatial & spatial)
Workflow building, process review, process automation, connecting and developing intelligent services.
Having struggled recently to recruit to a vacant post within the team I feel that salaries need to be reviewed and improved to reflect skills and technical requirements
Mandatory central geospatial resource for professionals to enrol as members and advertise skills, experience, qualifications and current availability - could also advertise all vacant geospatial roles centrally within this professional environment.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Emap contractor link
land reg full data - inclu property valuation estimates not sure if this LR
OSMM cloud tile service - avoid data distribution
PSMA use of addressbase API
Historical Air photo and mapping data
Emergency planning & response data amalgamated, standardised, centralised and updated service and legal obligation on authorities to participate and contribute.
National Tree Map
Vacant homes dataset (real time)?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

central maintenance
Open LLPG data to wider community
Centralise error reporting for LLPG - introduce a TELL GEOPLACE service or widen
Candidate process and expand potential partners
Work with partners such as royal mail to standardise and improve SNN notification and postcode allocation using LLPG or central maintenance
Be good to utilise property lifecycle process more and improve consistency of implementation
Opportunity to review change intelligence sources and implement standards and processes nationally to ensure required data is provided as needed
VOA - business rates integration and communication could be improved and would result in less fraud and better quality business data

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Invest in technology or services to support on demand surveying capabilities of small areas using drones or satellites

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Augmented / mixed reality
Data infrastructure
Real time data sources and processing capabilities
Autonomous machine learning apps and devices
Mobile Apps - geospatial based
Mobile geospatial sensor platforms
Improvements in wireless and web networks nationally
Investment and migration to the cloud - central pools of applications, licensing and data available for use nationally.
New policies and processes are needed to support such data collection, processing, storage, and sharing, as well as the protection of these systems.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

central maintenance

Tell Geoplace service - wider candidate processing submissions
Improvement and streamlining of property life cycle management, SNN and notification process & centralised standards and systems to support this
Digitising all planning history where it has not already been achieved

Monitor, record and manage vacant homes/buildings

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and

frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

[open] data standards
Legal aspects of collation and use of new data sources - drones etc.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Transferrable example of public : private collaboration to achieve common goal (ainc open standards): https://oixuk.org/

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

data inventory
data sharing agreements – use LGA services list and build by components
Standardised data capture conventions/policies/standards for common datasets - greenbelt, wards, planning applications etc.
Inconsistency nationally - makes sharing difficult and time consuming
Central data request and provision service - including management of any contractor and data use licensing that may apply
Restricted access to some data and some data unavailable (NHS, CRIME)

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Central maintenance services/real time LLPG data
Central management and processing of notification for address change intelligence
Implementation and streamlining of SNN function and processing

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

land reg full data
OSMM cloud tile service - avoid data distribution
PSMA use of addressbase API

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- property and land
- infrastructure and construction
- mobility
- natural resources
- sales and marketing

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

SDS Planning Hub
SDS AddressBase API

Q18: Are there any other areas that we should look at as a priority?

Central GIS tool access

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.
Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	emapsite
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Commission's work will inform the National Geospatial Strategy (NGS) in ways that have far-reaching implications. There needs to be some consistency within that NGS as to which terms and definitions are used and which data is intended to be covered.

For example, *"Information where place is a key feature of its source and/or purpose for which it is used"* is a phrase that wouldn't be recognised by practitioners, or in the general market place, as a term to cover what is commonly perceived and/or accepted to be geographic information or geospatial data.

It's common place for us to use both terms ('geospatial information' or 'geospatial data', or indeed 'location data'), either deliberately or by accident. The NGS could be adding to the lexicon of hard-to-handle phrasing for the layman – which appears counterintuitive.

This begs the question as to what is (and isn't) perceived or accepted as being relevant to those definitions. It could be "any data set or artefact containing the means to reference that data set or artefact in the real world". On the one hand, this would cover any dataset with coordinates such as GIS, EO, and some CAD/BIM/Digital Twin instances, in which most people are familiar with the idea of mapping and visualisation to understand location context. But on the other hand, these datasets are just the tip of the data iceberg. Over 80% of all data has some form of encoding or characteristic that allows it to be located in

the real world: CCTV, medical imaging, ANPR, mobile communications, blueprints etc.

This perspective on what "counts" was defined in the ISO/TC 211 series of standards as data and information having an implicit or explicit association with a location relative to the Earth. At the same time, the ICO has a very narrow definition: https://ico.org.uk/for-organisations/guide-to-pecr/communications-networks-and-services/location-data/.

So, while "it depends" is not a recommendation, it's clear that a coherent NGS will demand answer. The attempt to separate data types out is perhaps the cause of the 'problem': the Commission is trying to redefine a problem that may have already been solved. It seems that:

- By 'geospatial data', the Commission means GIS, BIM, EO etc.
- By 'positional data', the Commission means what is often termed "exhaust data" (we're not familiar with "positional data" to define the vast bulk of data that leaves or contains a geographic signature).
- By "geospatial identifiers", the Commission means the components on both of the above, which allow one to be linked to the other (place, XY, long-lat, address, UPRN, TOID, USRN etc); and this should be extended to recognise the infrastructure (i.e. the UK geodetic network) that makes highly accurate data capture possible.

If these terms are to persist, then the NGS will need a **glossary** that removes ambiguity and satisfies everyone involved: this is especially true when thinking about IoT, CAV, Smart, Digital Twins, BIM, gaming, telecoms, mass transit and so on.

In addition, the Commission will need to define which data types/sets are not included within the mandate of the NGS. **It is striking that geospatial and positional data from public sector entities other than the Geo6 are given little or no attention in this Call for Evidence.**

The data generated on behalf of the public sector by members of, for example, RICS, RTPI, RIBA, TSA, CICES, ICE etc (via commercial stakeholders such as engineers, developers and so on) comes from a wider ecosystem that's been entirely overlooked.

With respect to the fourth data type – "geospatial services" – there are other difficulties. The industry and the wider market that uses geospatial products and services sees 'services' as the mechanisms by which geospatial data, information and insight are delivered to users. The Commission's definition seems to parlay "information, products and insights" into a services model - which conflated two entirely different parts of the market place. This is especially unhelpful to industry but also to those who will be taking the NGS forward. Often, those products are processed and delivered in real or near-real

time with the delivery element being an intrinsic part of the product and its value to the end user beneficiary.

This appears to be an attempt to differentiate the supply/value chain – carried out in the main by third parties – from the data capture, cleansing, quality control etc of the Geo6. Unfortunately, the term 'services' is in danger of inhibiting perceptions.

Whether by accident or not, the Commission appears to be in danger of using definitions that would be unhelpful. It is not clear what the Commission wants to achieve, but the perception is that these are efforts to re-imagine well-established (but narrow) GIS dataset type thinking. This does not support innovation. It hinders the Commission's aims.

We recommend a wider definition that embraces categories 1-3 would suffice, and the set up of a glossary that can be widely adopted. As to the item 4, we question whether or not this is inside the remit of an NGS, as it refers to the value added by those using the first 3. To this end item 4 should be removed.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Sadly, it is easier to bring a computer scientist, software engineer or database architect up to speed with the demands and opportunities of geospatial data than it is to turn a GIS grad into a Python programmer. This has significant implications across any skills and training policy.

"Spatial is no longer special", and spatial data is broadly speaking 'just' another data type while the 'exhaust' data (which contains much of the content from which value is derived in a location context), is already in familiar databases. Deriving value is increasingly a database operation and not necessarily a graphical one.

While GIS courses have their place, there is a dearth of skills that add value in areas such as data management, data quality, data science and data analytics. There are many ways to address this problem:

- Encouraging software engineering, database, computer science, statistics, civil engineering, surveying, planning, architecture, land management and other undergrad and postgrad courses to include geospatial units, challenges etc
- Encouraging undergrad geography courses to include meaningful programming units
- Promoting the pathway from geography to data science and analytics

- Offer programming in secondary schools that includes geospatial challenges
- Promoting and supporting online learning/MOOC take up (Coursera, EdX, FutureLearn et al) and encouraging professional bodies to recognise such learning via CPD etc comparable to say RICS pathways.
- Structuring and promoting apprenticeships in non-geo disciplines (as per above) to include core geo and GI modules and training

There is a very notable skills gap among GIS grads who are not equipped for the challenges of analytics. Primarily, they are skilled to tell visual stories in a cartographic environment. This 'tradition' is a very long way from the demands of now and tomorrow. When we add in the need to understand EO data, and the data processing and analytics at the heart of the re-emergence of EO, then the (skills) gap widens further.

Significant further work is needed to investigate exactly where the gaps are. From an employer's perspective, the next round of recruitment will focus less on GIS and far more for those with a data background.

That message should be heard loud and clear, right across the education policy agenda.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Our need is for GI awareness and geo awareness across the board, from C-suite to customer service desk, from product development to service delivery, from marketing to user experience and so on.

In part this may be down to the archetypal perceptions of geography and partly down the fact that GI has been a "sector".GI literacy should be considered a pre-requisite in thousands of careers, not just those using a GIS. This is where the gaps are.

Effectively addressing such gaps merits GC funded projects in their own right – ideally at secondary, tertiary and adult learning levels. The demand is such that organisations are recruiting talent and then investing in vertical market and/or software specific training to bridge the divide – time consuming, costly, and risky (once trained, they move on).

Careers 'in the sector' is a misdirection. While 'geospatial' sees itself as an industry, it is holding back wider integration of geospatial data into the mainstream.

On the other hand. equipping grads and enabling employees to equip themselves with the add-on skills relating to GI could be transformative in widening integration, identifying opportunity (through data capture, management and maintenance, through data science, through analytics etc) and driving value.

GI does not exist in a vacuum. It is a component of everything from F1 to supply chain logistics to site assessment to safety of life to land development to risk premiums .

Engineers, actuaries, software engineers, database specialists, computer scientists, statisticians, operations researchers, systems analysts and others will all provide richer benefits to their employers when they can identify the role and utility of geospatial data and related tools in responding to modern challenges.

On the flip side of this are the risks of the “button” economy, where algorithms are embedded and accepted from the outset, while the concepts, biases and the nuances of different implementations of maths, stats, queries, big data, AI and so on are little understood.

Such ignorance has significant risks - loss of trust, diminution of data quality, inability to challenge and much more. This reinforces the point that this is about far more than awareness of GI as an input but really about some fundamental understanding of the tools by which all data is captured, managed, manipulated, analysed and presented.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

No one really knows the full extent, let alone the quality, currency, completeness, format etc. Nor do they know how easy it is to access or make available, or under what terms with what restrictions from 3rd party IPR, confidentiality or GDPR type reasons.

There have been repeated - failed - attempts to extract underground and some overground network and asset data from the utlities, telcos, pipeline and other entities that are responsible for installing, operating and maintaining our national infrastructure.

This suggests a lack of confidence about data provenance and quality that is likely to be a broad reflection of much historic, private sector, spatial data capture and management; it also demonstrates a wider concern about what could be done with that data with regard to the national security and liability implications.

The role of this infrastructure and the impact of its maintenance on UK plc makes this location data the primary missing piece of the national geospatial infrastructure jigsaw. Putting these arguments to bed (and satisfying liability concerns) and creating access mechanisms to these data assets will inevitably form part of the GC mission.

Other data sets include:

- HMLR leasehold, day list
- MoD DVOF
- Mobile telecoms mast locations (OFCOM Sitefinder data dates from 2006)
- Planning applications
- Windfarms (location and boundaries)
- Solar farms (location and boundaries)
- Billboards
- IACS/CAP boundaries (i.e. where public payments made)
- Public Rights of Way
- ATMs
- DVLA/DVSA
- Fire and Rescue Authority boundaries
- Catchment abstraction and reservoir release related data sets (EA)
- UK Contribution to the European Pollutant Release and Transfer Register
- DEFRA data on GMO trials
- Mortgage and landlord possession statistics (MoJ)
- MMO data
- SPRI data
- CICA Aggregate Statistics
- GSNI data

The search on data.gov.uk gives 7,400 results for 'map' (18 Oct 2018), 66 for 'imagery', 1207 for 'geography', 4716 for 'soils', 1589 for 'marine' and so on….

There may have been only two requests for data to be opened, when ODUG offered a portal to make such request, although there are many FoI requests for geospatial data or data with geospatial/positional charactersitics or attributes.

The message is this: there is a lot of data 'out there' but it is hard to know what data is there. Metadata is often insufficient to provide confidence about the data itself, whether it will be updated, coverage and so on.

Eight years on from OS's first open data initiative, and with a huge number of releases in the interim, there is a need for more evidence and use cases to illustrate not just where the value lies but what barriers have to be overcome and what the constraints still are in delivering that value at the time and on an on-going basis.

Otherwise, replication, multipliers and similar assumptions may be too optimistic or too pessimistic. There is a very real onus on the GC to unearth this contextual information around exploitation of open data to date, to ensure a better informed perspective on what to push for and where to push.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Addressing is essentially about certainty of identification of land and property – and the ability then to associate other data to that location … be it for navigation, service provision, analytics, insurance and so on.

Address is one way to make that identification. There are other methods including XY, long-lat, UPRN, TOID, UDPRN, land title, BS7776 records, what3words/discrete grids and UAC to name but a few. These have inherent weaknesses in relation to certainty of identification, often through concerns about 'quality' (which may infer authoritativeness, completeness, consistency, currency, accuracy, metadata etc.).

'Address' records originate with local authorities but are re-captured repeatedly by other agencies. Address matching is a whole skill set and industry that is predicated on resolving these issues. The Commission would benefit by engaging with GB Group, Experian/QAS, AddressCloud and others to obtain metrics as to the sub-optimal nature of the data sets that are passed through their systems.

Royal Mail Group appears to be preventing wide access to an agreed, if not perfect, set of 'addresses'. But re-inventing those addresses as OpenAddresses, or trying to build an IPR-free replacement using BS7776 and other records, seem perverse ventures. It is the inconsistent, repeated, iterative capture of those addresses across the digital economy that is the 'grit in the system'. This occurs primarily because there is no universal adoption of address look-up - presumably due to pricing and licensing concerns.

As with so much cost, it may be there is a false narrative at work. Unless and until RMG release and maintain addresses at the behest of the nation, there is a role for some kind of education programme that can unlock the impacts of the grit.

It would be appropriate for the Commission to establish an evidence base with case studies that look at address duplication, and associated overheads, to resolve the impacts … and to bring RMG/PAFAB, OS, GeoPlace and others together to explore which mechanisms could move the dial in favour of national benefit. Certainly, there would be benefits to the public purse – and this would likely unlock further layers of innovation and efficiencies for both the private and public sector. Not least, due to the demands of the next/current evolution in a digital society, notably ubiquitous IoT deployment, massively densified 4G and 5G telcomms networks, the roll out of Smart City models with Digital Twins, BIM and Smart Grids embedded within them, and with CAV and surveillance just around the corner.

This matrix of tools and technologies will be generating and analysing huge volumes of data in real time at both macro and micro levels.

It will have to meet the needs of smooth traffic and energy flows on to ensure emergency services reach an incident as swiftly as possible. Locations will retain their vernacular addresses (name, number, street, postcode) but in the systems that run the country beneath our feet -- in those buildings, on those streets and above our heads, for scenario planning, future modelling etc, -- the term ‘address’ will be little more than a human cipher for a set of coordinates and metadata.

Meanwhile, commercially-focused and authorities’ engagement with citizens will still be via address --- and for those two ecosystems to interact effectively, consistent current addressing will be critical.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Commercial high resolution (sub 1m) EO data from Digital Globe and others sets a benchmark and establishes a resource that UK should seek to exploit rather than replicate.

The UK has some fine space and ground segment businesses such as SSTL (who build and deploy lower resolution EO sensors to great effect, as does Copernicus). UKSA can provide the evidence for intervention in that industry and whether it is worthwhile trying to compete.

The UK is accustomed to using 25cm aerial imagery but frustrated by the lack of high repetition to help with land use and other change detection within and between years and in the longer term. Digital Globe's data repository offers access to repeat cover that even in cloudy UK conditions provides 30cm data for any such change studies.

The Commission could support projects that piloted the use of Digital Globe and other high resolution sources in meeting specific challenges e.g. identification of non-native species, garden-grabbing, green-grey change.

Where successful, the Commission might support cross-government agreements with commercial EO vendors in which goverment agencies could contract commercial expertise to analyse discounted data on government's behalf. This approach could stimulate all parts of the UK space economy while providing benefit to Govt and UK plc.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

We are not sure that it is the role of GC to pick 'winners' in the technology stack per se.

However, it is clear that earth observed data and very large dynamic databases and associated technologies are at the heart of the digital economy.

If these are to be effectively exploited then it is less the technology itself and more the capacity, competency and resource to do so that is essential. This comes back to training and education that brings geo into the realm of software engineering, computer science etc so the next generation of programmes, analysts and developers can readily deploy AI, NLP, ML etc to the data at the appropriate place on the network, be it 'at the edge' or for heavy lifting.

These are sophisticated demands that change little even with the likely rise of quantum computing. Most of the techniques are well-established: bringing them to an ever richer data environment to deliver consistent outputs and outcomes is as much an engineering, architectural and systems challenge as it a geospatial data one (which of course brings us back to who builds the systems / algorithms and what biases might/do arise).

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

They just will. The data streaming in from IoT, CAV, 5G, smart grids etc will have embedded geospatial characteristics. For the outputs and outcomes to be 'trusted' (and not to alienate or disenfranchise), places significant demands on those delivering them to educate, explain, to be transparent about the mechanisms and tools being used.

Analytics, algorithms, artificial intelligence etc are already common currency in the media but merit a sigh of exasperation from a population that already takes 'smart motorways' in their stride – with little exposition or explanation. Populations care when things don't work, not when they do . The absence of mobile connectivity on M3/South West trains corridors is a far more audible issue than that we have 60Mbps FTTP.

Those parties rolling out new technologies must ensure the embedded data they're capturing is effectively stored, analysed, and acted upon so that the citizen can live, work and travel safely, swiftly, efficiently. These are very real concerns which bring focus to geo-aware smart systems design, database tech/tools and the skills to deploy them appropriately and effectively, without bias.

Predictive/scenario modelling transparency offers one route to build confidence for practitioners and public alike – "this is the data, this is the scenario, this is how we all the players are predicted to react" – though it's not an exact science and the citizen mostly wants to 'just' be minimally impacted.

This topic is an important consideration for the Commission, as, without consistent authoritative data that can be easily cross-referenced/linked, predictability, planning etc become much harder. The long-term sustainability and availability of the underpinning data sets is a fundamental tenet of an effective, functioning, modern digital economy.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

This response demands that national and local geospatial infrastructure data capture (from OS, HMLR, UKHO, Met Office, VOA, EA, BGS, local authorities) be sufficiently resourced. This cannot be an infinite resource chasm. Rather, it needs to be a set of outputs that, together, consistently and sustainably, meet the needs of government and UK plc. This means identifying duplication, setting priorities based on the value of real world outcomes, identifying where that value derives, investing in skills and technologies that improve/automate capture and quality and so on.

This exercise generates some long lists (of data and of outcomes met as a result) and some big numbers. It also identifies where the value falls and, proportionally, the 'cost' of geospatial data. Typically this builds cases for mandated standards-based data collection within some form of public task on the one hand and a commercial data model on the other. With such a conclusion come the barriers associated with non-open data, therein exposing a conundrum.

The alternative is central government funding, direct or otherwise. Few of these agencies would get individual line billing in the Chancellor's budget. The sought-after sustainable geospatial data infrastructure would be subject to future government whim. We hope that the Commission's role will change that narrative, putting the underpinning data at the heart of a long term national geospatial strategy through a compelling evidence base and value proposition.

That doesn't make the current mixed model (for Trading Funds/GovCos) perfect. It has, however, survived so far. And it has nurtured a value-adding partner community that is energetically breaking geo into new markets with innovative applications.

For those organisations such as TfL - producing geospatial exhaust data that's become part of the national geospatial data infrastructure by default through CityMapper and other applications – there are risks. Tesource pressures and changing priorities may result in deterioration of data quality or structural changes to the data or shift in or absence of publication/update/maintenance or introduction of commercial data models that have knock-on effects for app builders and UK plc.

DEFRA's 8000+ data sets are interesting but certainly not exemplars of metadata, maintenance, time series anlaysis etc. And yet they could be, with a coherent strategic approach to maintenance and publication.

It would be relatively easy to justify maintenance and release of all kinds of data assets but there are risks with choosing not to. It is worthwhile investing in maintaining and developing (enhancing, improving, modifying etc) core geospatial data assets – to do so is not a cost to the exchequer or to industry or the end user or to the citizen beneficiary.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Staying in ESA (in which UK has played a significant part). ESA's technologies provide geodesy, comms, positioning, navigation etc and a whole array of EO platforms.

As to indoor networks, the market is currently working out which of the competing technologies is suitable for any given environment. It might be counterproductive for the Commission to intercede.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector already has many roles:

- Contributing taxes that are distributed/spent in the Budget
- It pretty much powers and runs the internet and all the infrastructure that sits on top of it to run the web
- Develops the technology to capture, store, analyse, distribute data
- Deploys technology on behalf of the public realm (outsourcing, contracting etc – from satellites, to imagery, survey, GNSS networks, IoT infrastructure etc)
- Creates products and services for customers (B2B, B2C, B2B2C, B2G) using public geospatial sourced data assets that meet or stimulate a market need
- Returns monies (via pricing and licensing agreements) to source agencies

There are specific areas in which there should be a more direct linkage between the competency of the private sector, the revenues and taxes they generate and how those are fed back by government into the public sector geospatial ecosystem. But there are also things that the public sector geospatial ecosystem undertakes now, which might appear to be a 'stretch' of what a reasonable 'public task' might look like in the future. Those activities could probably be better undertaken exclusively by the private sector.

Most public sector agencies with core data capture and management mandates are the larger players in their part of the ecosystem. They have the financial strength to undertake the R&D, product development, market testing and PR to participate in any part of the value chain. Arguably, they over-reach in that task. But they are free to do so when the 'competition' is smaller and the primary customer is a needy public sector.

This risk is well recognised by the private sector. Eight or so years ago, the Locus Association suggested that this is holding back private sector investment and innovation.

This risk remains. Investment and innovation are the spurs for wider and deeper geospatial data creation, use and integration, so we recommend that the question is refocused: “what role could the private sector play if public sector player public tasks were more clearly and narrowly defined and governed?”.

Government has made great play of SME-friendliness in recent years. The private sector has responded where it can, through G-Cloud and by joining alliance and partnership programmes to speed up time to market and public sector access to agile, innovative applications of geospatial data.

There remains much to be done by the public sector agencies in relation to their data capture, quality control and management programmes. It seems counter-intuitive that they should be moving into the value chain rather than strengthening UK plc through higher quality, more consistent, richer attributed, more frequently updated national infrastructural data sets.

Defining public tasks across the public sector that can put good data governance as the primary goal would stimulate greater investment in downstream products and services using that data in both new and existing markets. Ultimately, that is the role that the private sector should play.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The challenges working with public geospatial data fall into a number of categories:

- Data related (poor quality, timeliness, currency, coverage, accuracy, resolution, consistency, metadata)
- Format related (steadily reducing as an issue on the back of BSI, OGC, ISO and others' work on developing and promoting standards – there are 85 current and 47 in development standards in relation to geospatial in BSI alone)
- Software related (failure to adopt standards in full or at all, creation of new 'standards')
- Application related (the world of CAD, GIS, BIM and Smart are only slowly coming together with interoperability of software and data models that can realise the value of Digital Twins, or support smart infrastructure or underpin CAV some way off)

The professional and commercial world informs and develops the standards, tools and software that allow value to be realised from the data. If the data is poor then the value is diminished whether that data is public sector or private sector sourced.

The remedy, therefore, is to fix the data quality challenge. This plays back to how public tasks are defined and the terms by which they are delivered. A couple of examples:

- Is it good enough for example that a "new" housing estate in a rural location is not available within OS MasterMap (OSMM), 18 months after the residents have moved in, and what barriers does that provide to provision of for example broadband services or utility maintenance? OSMM is used as the frame of reference by HMLR, utilities, contractors, HSE, local authorities and others.

- Should OSMM or OS Highways contain information about road condition or of adjacent pavement material or condition? If it did (i.e. was subject to greater data capture frequencies), wouldn't local authorities (LAs) would have better oversight of road type and contractor performance; couldn't they make comparisons with other LAs; couldn't contractors provide better cost and time estimates for installation of pipes or fibre depending on surface covering; wouldn't we see reduced congestion (and related costs), speedier times to market, better delivery performance and/or delivery targets?

- Is it helpful that identifiers (particularly addresses), are not used consistently and that joining data sets reliably across OS, HMLR, VOA, Coal Authority, local authorities etc remains a major part of many/all data integration and analysis initiatives?

The technology exists to capture this type of data at the required frequencies. And to process, store and distribute it using distributed database architectures, perhaps on a federated model (so there is no one 'agency to rule them all'), adhering to appropriate standards.

A lot of this will come from earth observation, where high resolution, high repeat coverage, cloud compute resource, machine learning and AI converge to provide highly automatable workstreams.

As EO data slowly commoditises, the private sector will increasingly pick up these tools, in the same way that they now augment public sector spatial data, but, if the public sector agencies don't respond, the private sector will leverage that capability to build their own versions of the world they are interested in.

Broadly speaking multiple versions of the built environment will not end well!. We would counsel that the ambition should be for many applications, solving yet more problems … represented to the end user in many different ways (some of which may even involve a 'map'), but all using the same baseline data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission should be an intelligent gatherer, broker and analyst of customer requirements, filtering them through the lens of the respective public tasks to the Geo6 (and out to other agencies at all levels of government) so as to drive their priorities and behaviours in response to those public tasks.

At the same time the Commission could perform the same role with respect to market making for the private sector, differentiating the public sector requirement as end user (needing a 'solution' of some kind be it an application, product or service) from the actions needed by the Geo6, generating wider market awareness of the opportunities in the value chain for those pubic sector buyers to meet those end user needs.

This could be in specific data capture, spatial intelligence advisory services, product know-how, sector competence, platform exploitation, software development, service configuration and more. This then plays to the investment and innovation positive feedback loop above.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

At risk of repeating Q4, but taking the perspective of the value of consistent national data sets to the collective endeavour of UK plc., there are areas where fragmented data collection is a barrier to benefit:

- Underground assets (as above)
- Planning applications (how can there be effective national and regional planning without a more coherent underpinning data resource)
- Land use (for land use planning, something many other countries are far more diligent about in respect of impacts on and risks to national infrastructure from for example flooding caused by land use changes within catchments); RPA (and devolved equivalents) have a role to play here in their coorindation of payment claims under CAP/IACS/SPS/ESS etc), as does EO.
- Emergency planning and resilience agendas require local, regional and national coordination: climate change, coastal inundation, smog, fire (residential, industrial, forest, moorland), catastrophic industrial event (e.g. Buncefield), very large crowds (sports events, protests, celebrations, festivals), major transport incidents (e.g. M5 fireworks crash, Ladbroke Grove, Herald of Free Enterprise), flooding, freezing, brown-outs etc
- The “broken” housing market – there is scant evidence that spatial data or the lack of is a significant barrier. But there are data sets (from HMLR, MoJ, CICA and elsewhere across the public domain) whose use (and/or licensed release) could guide local, regional and national planning policies and actions in response to both meeting very short-term need and long term solutions, for example through access to property lease information

Protecting personal data is essential in these activities. Concerns should be mitigated by appropriate contracting / data sharing provisions and anonymisation or pseudo-anonymisation so that valuable mosaic analyses can be undertaken to better inform policy and action.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The Geo6 may represent the beating heart of geospatial data in the UK. But the Commission knows they are far from the only players - even in their own domains within the whole of UK. RoS and LPSNI are the most obvious counter-parties in the devolved administrations ,while EA/SEPA/NRW/NIEA is one set of important geospatial players with no direct oversight from the Commission.

This makes a national geospatial strategy a matter of collaboration, leadership, compromise and context or territory specificity. This requires the Commission to work with all key stakeholders to establish a framework that will allow the strategic elements that speak to such regional variation to be tied together.

Current activity and the first annual plan will benefit from a workstream dedicated to discovering and coordinating existing and planned priorities; assembling showcase examples of success; diluting or dispensing with red-lines; and further evidence gathering in public and private sector – drilling down into what geospatial data exists or can be used to deliver value across the stakeholder ecosystem.

The Commission will be able to develop a high level but focused strategic framework and identify the policy and technical levers available to steer national and regional activities in line with overall strategic priorities.

As a new player in an established community, gaining rapport with key voices is important. Identifying current best practices (and indicating that there is no intention to reinvent the wheel) will reassure practitioners who are often very close to the ground. Signalling that the intent is to take the best of spatial thinking and leadership and to condense and refine that distributed insight into a nationally visible and centrally supported vision will create collective ownership of the initiative while leaving space for creative re-imaging of key themes within the resulting strategy.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The short answer is to use the available levers, groups and gatherings:

- PSMA and PSMA user group(s) and events
- SOLACE
- SOCITM
- GeoPlace
- Approved training programmes

These divide into:

- technical type initiatives on standards, inter-operability, procurement, job descriptions/recruitment, online learning (e.g. MOOCs), software specific training, writing business cases and publishing use cases
- policy lead initiatives from high level awareness of the value chain to sector or problem-space applications that harness geospatial data to help address real world challenges (in housing, social care, waste, education etc)
- data related initiatives – consistent data capture e.g. BS7666, effective data management and storage, software choices, data sources, GDPR, analytics, cartography and communication

Too often, data ends up being left in silos. Not maliciously, but for lack of policy, technical or data awareness, leadership, drivers or understanding or lack of resource or time to think differently while still fulfilling front line imperatives.

This last point, where ‘doing fancy things with the data’ or even thinking about what could be done is off the agenda, is oft-forgotten. Typically key staff are doing the very best they can. Investment is required to provide the headroom to think, analyse and apply and deliver savings and benefits.

The Commission might want to consider some form of funding for specific challenges or problem spaces as ‘projects’ or to support showcasing successful initiatives in roadshows or other formats. The aim being to reduce friction in and resource required for replication or modification to local circumstance but without requiring technical investment by GC or R&D type funding by the local authority.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

See Q14 also:

Property and land

- land use change (from short term for agriculture to seasonal, annual, regional, longer time series)
- the 'broken' housing market
- planning and development – effective site identification, acquisition etc – planning applications, planning envelopes, conservation areas, planning constraints, compulsory purchase due diligence, valuation – disconnect between VOA, HMLR and OS MasterMap (and Addressbase) could be improved by GC governance in their improved data sharing, coordination, use of identifiers and registers
- invasive species – if reports of incidents/outbreaks (currently typically to or by insurers and to responsible agencies) e.g. ash dyeback, Japanese knotweed, carpet sea-squirt were available as 'training data' new techniques open up possibility of early identification
- renewable site selection (onshore and offshore – Crown Estate and MMO as well as UKHO)

Infrastructure and construction

- undiscovered leakage – given sufficient training data (i.e. of old/known leaks) new techniques open up possibility of early identification
- GC has a role to play in the wider public realm in helping to break the barrier between construction and facilities management (FM) in maintaining the fabric of (digital) built Britain; with the mandating of BIM for much modern construction there is considerable baseline investment in delivering the digital twin, 'smart' environments of a 21st century economy; yet the disconnect between BIM, GIS and FM negates that investment, often leaving building management and maintenance to more traditional approaches, risking asset value, building integrity and safety and security. There is a lack of joined up thinking from developer to architect to engineers to owners, occupiers and FM that merits a more detailed investigation in order to establish the causes, consequences, risks and costs and

look at mitigation, such as appropriate programmes and incentives run primarily through professional bodies such as RIBA, ICE, RICS etc
- Telecoms roll out (wireless internet, 5G) – planning, costing, prioritising – private sector spending millions, govt also investing heavily; new techniques optimise network planning but are constrained by data quality; maybe role for GC in collective bargaining with data sources

Mobility (presumed to mean Transport as a Service type applications rather than travel for the disabled)
- Very well catered for in London but less so elsewhere in UK owing to inconsistent publishing of relevant data; much is made of the odd few seconds of time saving theoretically enabled by apps such as CityMapper but that reality is more prosaic and direct linkage with change of transport mode and resulting benefits in terms of GHG, long term health etc is hard to establish

Natural resources
- Fisheries
- Forestry
- Water and groundwater including pathways
- Air
- Agriculture (precision ag and drone use already advancing)
- Protected areas
- Landscape (urban including iconic views and rural)
- Geology (including subsidence, heave)
- Coasts
- The weather (wind, sun, rain, tide – or wind, solar, hydro and tidal!)
- Oil and gas
- Flora and fauna and biodiversity

Natural resources are literally all around us. Our wellbeing as a nation and planet depends on sound, sustainable decisions in relation to our interventions in them, from explitation to management to leaving well alone (as far as possible given how natural processes and cycles work everywhere).

Much of the nation's long term economic value is embedded in one shape or form in our natural resources. But with agriculture, forestry and fisheries low single digits of GDP the direct connection can be mislaid. Factor in tourism, species diversity, environmental health, pollution, flooding, disruption when any part of it goes wrong reveals a different and compelling perspective to use geospatial data and tools to help support understanding and build awareness.

Will the RoI be easily measurable? Perhaps not in the short term. But our natural environment is about the long term.

The Commission should open up channels with relevant agencies (CEFAS, MMO,

Historic England, Forestry Commission, Natural England and their equivalents across the devolved administrations) to identify areas that justify Commission-backed initiatives to better understand the role of geospatial data and tools in delivering sectoral value.

Sales and marketing
We would all welcome better targeting – less spam, less wasted paper, less recycling, less delivery HGVs. There is a potential discussion around personal data here for the Commission, but it may have a role in helping to drive down HGVs and waste through exploring how geospatial data is used by the likes of Demographic User Group members including DunnHumby and Dun and Bradstreet.

Q18: Are there any other areas that we should look at as a priority?

See Q19 below

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The more obvious ones include:

- Smart Cities
- Smart Grids
- Smart Home
- Connected Autonomous Vehicles (CAV)
- InLink and related (inc CCTV) embedded ubiquitous surveillance
- 5G/telco
- Drones
- EO

Many of these have common charactersitics in that they make similar use of network, IoT, always-on, high data volume, AI-informed, edge computing capabilities to deliver near real time responsiveness, securely and to a specific set of location-defined stakeholders.

Although most citizens will remain blissfuly unaware of this digital paradigm, they will demand that it 'just works' and be frustrated when it doesn't, or when their trust in it is breached in some way.

There are regulatory challenges at every turn and as with drones the regulations are a long way behind not only the art of the possible but its operational practice.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We should remain as invested players in INSPIRE, Copernicus, European Space Agency, Eurogeographics, UN-GGIM, GEO and all of the other cooperative European, north atlantic and global collaborative, partnering, membership organisations directly and tangentially in the geospatial domain.

We should ensure we are equipped in terms of personnel and funding to participate in and contribute to standards in the geospatial domain. Most of this is done voluntarily or as part of other day jobs in the UK but to a very high quality and globally appreciated.

We should demonstrate commitment to the principles of open data by ensuring that agencies releasing data sets document and maintain i.e. update them to create meaningful time series for analysis.

The UK's relative success in the space sector is to be celebrated with UKSA and Satellite Applications Catapult taking the lead. GC will doubtless be engaged with both entities to ensure optimal collaboration in strategy development and supporting downstream access and analytics.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There are national and sectoral geospatial data exemplars around the world from New Zealand to Estonia, Netherlands to Singapore.

Many of the best examples are in small nations and relate to geospatial policy both at spatial data infrastructure level and in relation to land administration (an area where the UK has a somewhat anomalous situation owing to a lack of a cadastre).

Heavily devolved Switzerland with its quasi autonomous canton structure is well regarded and may provide some valuable insights into stabling a credible national geospatial strategy that resonates and guides but not imposes at canton level.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission Call for Evidence
English Civic Museums Network Response

The English Civic Museums Network was established in 2015 to bring together senior museum professionals from organisations with similar backgrounds and governance structures to explore the potential for forming a mutual support and development network, focusing on developing a strategic response to long-term public funding issues. The network represents over 40 regional museum organisations and members meet up to three times a year.

Civic museums have been in the business of collecting data about people and objects in relation to a particular geographical location for over 200 years. Their amassed collections hold a unique and invaluable big data source that collectively encompass the stories of English life and natural heritage covering millions of years, and represent the nation's historical geospatial archive. It is a growing resource, with artefacts, photographs, archives and data reflecting contemporary lives and environmental character continuing to be collected.

'Museums use their collections and knowledge to support society in direct ways. They bring people together and promote community cohesion, they support learning, tailoring their programmes to the curriculum and local education priorities; they assist scholarly research through partnerships with universities; they can promote better health – for example, using collections to work with patients with mental health issues; and they employ and nurture a wide range of skilled people. They also offer spaces where we can experience beauty and understand our place in the world. It is a consequence of all of these factors that our museums are integral to placemaking and economic regeneration, domestically and promoting Britain on the world stage.'

'Museum collections often tell this story of a place and its people – what makes it distinctive, as well as its connections to the world beyond.'

(The Mendoza Review: an independent review of museums in England,
Neil Mendoza, November 2017)

Civic museums hold this material sense of place on behalf of present and future communities. They are adept in the physical world at sharing content in ways that invite users to make diverse connections and generate stories, bringing this data alive in support of wider social impact and economic regeneration themes.

The Story Lab at Birmingham Museum and Art Gallery *is a project designed to explore two questions. What would a museum look like if its collections, environment and staff developed and fostered a space that encouraged conversation about the objects? And, what if those objects had been chosen from a preserved collection by the general public, who has contributed meaning from them through personal connection? A team of curators, designers, exhibition experts and community engagers teamed up with a group of community artists, writers and activists to create a new gallery space aimed at testing storylines and their connectivity to the people of Birmingham. With voting booths, spaces to debate and events to blow open featured topics, the idea of a Museum for Birmingham is being tested. An environment encouraging visitors to feel a part of the fabric, part of that journey.*

The World Stories: Young Voices gallery at Brighton Museum and Art Gallery *explores global culture through the eyes of young people. The seven 'World Stories' were created in partnership with young adults and teenagers from Brighton & Hove and people with links to the places and cultures reflected in the World Art collections. Each story explores how, in different places and in different ways, culture brings people together.*

Inuit Elders from the Torngasok Cultural Centre in Nain, Labrador and the Kitikmeot Heritage Society in Cambridge Bay, Nunavut gave personal responses to images of objects from Canada in the museum.

'Knowledge and tradition were passed onto us as young people…Our parents taught us how to respect the land, the animals and our culture. We do not want our youth to lose what is within us.'
Lena Ayalik Kamoayok

Students from Patcham High School in Brighton created an animation about hunting and living on the land inspired by Arctic objects in Brighton Museum.

Increasingly museums, and other cultural organisations, are embracing the opportunities provided by emerging technologies, including geospatial. The recent DCMS report, *Culture is Digital*, published in 2018, emphasizes the importance of 'culture and technology working together to drive audience engagement, boost the capability of cultural organisations and unleash the creative potential of technology'. As an integral part of our wider collective and individual ambitions, members of the English Civic Museums Network are keen to work with the geospatial technology sector to harness ways in which collaboration could open up the power of museum collections to 'shine an increasingly bright light on our place in the world'. The opportunities presented by these technologies to reach physically and conceptually beyond the walls of a traditional museum building, and allow people to explore their locality and connections to wider people and place, adding content of their own, are tremendous. They are also largely untapped.

It is within this context that we share an emerging vision:

Creating a dynamic cultural and natural heritage geospatial learning resource will be game-changer. A virtual museum of the twenty-first century that connects with, and ties together, the physical museums rooted in place. Millions of people access and use museums in their locality across England every year, and thousands visit from other places in the UK and overseas. Many millions more engage digitally online or through social media. What better platform to market the power of geospatial data to enhance lives and communities?

And submit the following answers to questions from the Geospatial Commission.

Thank you for the opportunity to do so.

GEOSPATIAL COMMISSION CALL FOR EVIDENCE, 2018

SECTION 2: EMERGING GEOSPATIAL STRATEGY

Question 1: Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

We are comfortable with the geospatial data types described, and would place museum collections primarily into the category of geospatial data (information where place is a key feature of its source and/ or purpose for which it is used), although museums can sometimes manage it as positional data (groups of individual datasets that usually have location as a secondary purpose, and which describes activity or physical assets grounded in a particular place).

Museum collections are varied in content and in terms of degree of recorded location information accuracy. Archaeological archives and natural history collections will ordinarily have reasonably specific source site information, compared, for example to social and industrial history collections. But there will frequently be information associated with such collections that enable greater location accuracy than general place information. E.g. used in a named factory or bought in a named shop. However, this more detailed geospatial referencing will rarely have been translated into GPS coordinates. World collections housed in many civic museums (objects that came from other parts of the globe, usually during activities of empire in the nineteenth and early twentieth centuries) are of interest in having two geospatial references – the international place from which they were collected, as well as the local English civic stories which led them to being part of a particular museum collection – usually donated by the collector or family). These collections lend a direct international dimension to the project, although many other types of collections have an international connection.

SECTION 2: SUPPORTING INNOVATION IN THE GEOSPATIAL SECTOR

Question 2: In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capacity within the UK for the future?

We are delighted to see that the Commission intends to work with leading representative bodies including the Royal Geographic Society, Association for Geographic Information, UK Research and Innovation (UKRI), and the geographers within the Government Science and Engineering profession. As a representative organization of another key stakeholder across industry, academia and the public sector, the English Civic Museums Network would welcome the opportunity to work with you to support UK museums in developing their geospatial capability.

Question 3: What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The civic museums community is beginning to develop an understanding of the potential for emerging technologies, including geospatial, for transforming the place-making role of museums. For example, a piece of research is planned to audit existing activity by individual ECMN members, several of whom are working in collaboration with academic partners.

We would welcome the opportunity to work with the Geospatial Commission to develop an understanding of the geospatial skills needs, and therefore gaps, in our member organisations. We can see potential opportunities to engage with, and support chartership syllabi, and the emerging Geospatial Mapping and Science apprenticeships. Museums may be able to play a powerful role in promoting careers in the sector through their access to young people across England via informal and formal learning programmes.

Question 4: How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

English civic museums look after millions of collection items, holding detailed historical and contemporary geospatial data for any given location about changes in human activity and environmental character. This data is of value in a number of potential economic and social contexts:

- In-depth understanding of environmental, climate, demographic and social change variables over time, helping to inform, for example, planning decisions

- Inspiring new generations of citizens to have a global outlook and an interest in community that drive England's economic and social future

- Enabling established and new communities to explore identity and belonging, in support of community cohesion, wellbeing and sense of place

- Supporting the revitalization of cities, towns and rural spaces as destinations, by creating digital heritage experiences

- Facilitating the development of new ideas and innovation by researchers making connections and identifying trends in big information datasets

- Creating a rich pool of inspirational stories and content for use by artists, writers, architects, film-makers, game designers, and other creative industry businesses

Civic museums provide varying degrees of public access to their collections data online at present, and it tends to be presented from an institutional (by museum, exhibition or subject theme) rather than a place and people-based perspective. There is minimal opportunity for people to start from the perspective of place, to connect content across collections, or add their own knowledge and stories as content. Museums are only recently beginning to open up the data held in their collections, through initiatives such as Creative Commons. ECMN would welcome the opportunity to explore these opportunities and issues further with the Geospatial Commission, and connect with initiatives such as the Open Data Institute in terms of current research and development initiatives.

Question 5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes?

We have no specific view on this question, other than ensuring flexibility of level of detail to ensure that data with differing degrees of GPS accuracy can be incorporated.

Question 6: How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

We are interested in exploring the development of an application which enables the geospatial data and associated stories held in civic museums to be easily uploaded into and presented via a virtual interface with a base layer of earth satellite imagery. An interface that easily allowed members of the public and learning groups to drill into the geographical detail of place, explore content by narrative theme, and add their own geospatial historical content to enrich the resource. Examples of interfaces currently available include Google Earth, ESRI ArcScene and OpenStreetMap – all US developments owned by major corporations. All provide interesting learning opportunities for our sector, but do not provide the easy to use and explore functionality which would ensure the resource was able to deliver effectively on all of the uses identified in question 4. Is there a market opportunity for the UK to take a global lead in this area, given the rich cultural and natural heritage collections the UK holds related to local, national and international cultural and natural heritage.

There are a number of initiatives that bring collections information together from various heritage sources (Culture 24 for example), but they do not use place as the entry point for discovery. One notable exception is Know Your Place (an initiative developed in the West of England), which has the functionality to map place-based heritage content onto modern and historic basemaps, for specific locations. However, it does not utilise modern earth observation imagery, which could be a more relevant visual representation of place for today's audiences (see Baroness Martha Lane-Fox quote on page 8), does not facilitate story connections across narrow geographic boundaries, nor does it facilitate easy addition of user-generated content.

Question 7: Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Question 8: How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The geospatial opportunities relating to museum collections described above contribute to each of the four Grand Challenges set in the UK's Industrial Strategy: putting the UK at the forefront of the big data revolution, and supporting activities around mobility, clean growth and ageing society.

'I've often returned in my mind to Mary in Newcastle, who is a disabled full-time carer for her heavily disabled husband. She was sinking fast into a hideous depression until a local volunteer taught her how to use the internet. She told me it saved her life. Yes, saved her life. She felt her world expanded and that she could experience things she'd never otherwise have been able to do – she was "going on holiday" when playing around on Google Earth and getting priceless support from new friends she met in online groups. For Mary, getting access was the difference between coping and not carrying on. For all of us, her going online meant that she was relying less on health services, and doctors'.

(Baroness Martha Lane-Fox, 39th Dimbleby Lecture, 2015)

Our big vision is for a global creative geospatial resource, developed through the adoption of human-centred design principles, that exploits and promotes the international brand of UK museums[1] and acts as a high profile example of the UK's leadership in data technologies.

It will connect with advances in technologies that enable effective storage and rapid processing of large multimedia datasets from multiple sources to deliver connected stories, ensure excellent user experience, and support comprehensive data analytics about people's relationship with place for economic and social benefit.

It will connect with advances in Earth Observation image data to create a user interface which is easy to access and contribute to for content providers (including museums and private users). Something that brings together the user capabilities of the likes of Wikipedia, Facebook, Twitter, YouTube, Vimeo with a dynamic earth observation interface, and an exploring, game-style experience.

It will connect with advances in technologies involving 5G and the Internet of Things, allowing connected earth museum content to be discovered and interrogated in the detailed topography of landscapes and streetscapes.

[1] The UK is 5th in the global innovation index and the nation's heritage, historic buildings and monuments are ranked 5th on the Nations Brand Index. (DCMS, Culture is Digital, 2018)

SECTION 4: ENHANCING THE UK'S GEOSPATIAL ASSETS

Question 9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Many English civic museums are recipients of declining local government funding, and are under significant financial pressure. ECMN was established as a response to this challenge, and is focused on working collaboratively and innovatively to champion the ongoing social and economic place-making purpose of museums. We have recently published *The Future of Civic Museums: A Think Piece*, in partnership with the National Museum Directors Conference. It will be launched at the V&A later in October 2018.

The concept of bringing together collections data within a place-based (geospatial) framework is an opportunity within this wider context, as are a sharing of digital capacities, and collaborative investment initiatives. The opportunity to work with the Geospatial Commission and its Partner Bodies, particularly the Ordnance Survey, to explore opportunities and issues further is of interest.

Question 10: What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

Nothing to add on this.

Question 11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private partners could bring skills, expertise and investment into the development and maintenance of infrastructure, with return on their investment including technology r&d and data analytics, as well as contributing towards their corporate social responsibilities. Their support of a mainstream learning resource, that involves the active participation of young people via museums, may also create a pipeline of apprentices and university students interested in following technology careers. Apprentice partnerships could be established, hosted by museums and sponsored by the private sector as an example of this in practice.

The Block2block: New Milton in Minecraft *project has created an innovative digital museum encompassing aspects of local social and oral history from World War II to the present day. The project ran from April to July 2018. A range of youth, media, creative arts and heritage partners supported and trained groups of young people from in and around New Milton. The young people took the lead in creating a contemporary collection, which explores the past and present day history of their local area.*

Working with Hampshire Cultural Trust's Forest Arts Centre, the young people researched and reflected on the history of New Milton through engaging with the trust's social history collections, as well as working with a local historian to uncover personal stories and memories from the town's people. They worked with local musicians, artists and film-makers to create films, songs and tell stories through drama. The contemporary media created was added into the Minecraft map.

The project attracted interest from Microsoft, the owners of Minecraft, who invited the young digital leaders to the Microsoft UK Headquarters in Reading to present their project and take part in a practical Minecraft training session.

Question 12: Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the operability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Museums (as well as other cultural and natural heritage content holders) would need to provide geospatial data to this learning resource under a Creative Commons or Open Government Licence arrangement. There can be reluctance within museums to provide open access to data, particularly if there is a private sector, commercial aspect to the enterprise. It would be important to ensure direct benefit to museums in terms of extending their social impact, increased footfall to their digital offer, and free/ discounted access to data analytics. The learning resource would need to be free for the Creative Commons licence to apply, and therefore its sustainability would need to be generated through a mix of commercial activity, tech sector philanthropic investment, and public support.

Location information is often recorded in museum documentation databases, but may not be in a format immediately compatible with wider geospatial recording. Museum documentation in the UK has a highly standardized approach, and a review of existing standards used by museums to incorporate an agreed approach that connects with wider practice being considered by Partner Bodies and the Open Geospatial Consortium would be required. However, various databases are used currently and there are likely to be challenges in extracting meaningful data for use in a geospatial context.

Museums are developing innovative visual, audio and virtual content associated with their collection holdings, and encouraging user-generated content. However, these tend to be one-off interpretation projects, and rarely incorporated into standard documentation practices.

A technical review of options for providing geospatial data is required.

Question 13: How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission should champion museums as holders of geospatial data, and adopt a cultural and natural heritage remit that encourages museums, other public sector bodies and private sector partners to develop a big data creative geospatial learning resource.

Question 14: Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We have answered this question in our other answers.

Question 15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The English Civic Museums Network is affiliated with the National Museums Directors Conference. It has close connections and collaborations with the wider museum sector across the UK, via formal and informal networks. Much of the geospatial data held in our collections is connected, and indeed this inter-connectivity would be one of the benefits. We would welcome the opportunity to engage with sector partners in Northern Ireland, Scotland and Wales on this matter.

Question 16: How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

Civic museums are rooted in community and have strong strategic and funding relationships with local authorities across England. Several of our members are in conversation with their respective LAs about the opportunities presented by Smart Cities and the Internet of Things. In our experience, there is a varied level of knowledge, expertise and appetite at member level for the potential opportunities opening up around digital and geospatial in terms of better delivery of public services. Cultural and natural heritage initiatives can be an important catalyst for wider public engagement in these opportunities, and consequent engagement by members in prioritizing and sharing digital.

SECTION 5: DRIVING INVESTMENT AND PRODUCTIVITY IN GEOSPATIAL APPLICATIONS

Question 17: As a result of this analysis we are prioritizing the exploration of possible initiatives in the high-value categories identified:

- **Property and land – geospatial data us**
- **Infrastructure and construction**
- **Mobility**
- **Natural resources**
- **Sales and marketing**

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

Museums hold geospatial data in their collections that shed important light on the cultural and natural heritage of an area which would be of significant value in terms of increasing the efficiency and effectiveness of property, land, infrastructure, construction, and natural resource transactions, in ways that capture economic value and look after our planet. It can also provide important creative inspiration and content for location-based advertising, promoting the unique experiential USP of place as part of any campaign – a factor increasingly significant in High Street transformation initiatives, for example.

Question 18: Are there any other areas that we should look at as a priority?

The call for evidence identifies that most of the economic and social benefits will come from identifying and exploiting new products and services, and that a key objective of the Commission is to invest in projects that can demonstrate new approaches and help accelerate innovation and effective adoption of geospatial data-based applications both in business and wider society.

Creating a dynamic cultural and natural heritage geospatial learning resource will be game-changer. A virtual museum of the twenty-first century that connects with, and ties together, the physical museums rooted in place. Millions of people access and use museums in their locality across England every year, and thousands visit from other places in the UK and overseas. Many millions more engage digitally online or through social media. What better platform to market the power of geospatial data to improve lives and communities?

Question 19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

Geospatial data relates to land, which in turn is property under ownership or subject to other sensitivities, such as protection of heritage sites from illicit excavation. Open access to cultural and natural heritage related geospatial data will raise data protection issues that will need to be given due consideration.

Question 20: How best can we make the UK's presence in the international geospatial world more visible?

English civic museums (as well as national museums) hold significant collections-related geospatial data relating to global cultural and natural heritage. The development of a learning resource that incorporates a global perspective would have a strong profile internationally, and develop international partnerships with museums and their communities generating content. The number of people engaging with civic museums across the globe creates an even greater brand profile for UK's presence in the international geospatial world.

Question 21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modeled overseas that we can learn from?

We are not aware of any specific collaborative international initiative to harness the geospatial potential of museum collections. There are a number of collaborative digital ventures involving museums – Europeana, Canada's Virtual Museum, Culture 24 and Google Arts and Culture, for example – but they do not reference geolocation data. Indeed, there are only a few examples we have come across to date of individual museums doing so for their own collections – the Museum of New Zealand Te Papa Tongarewa is a good example.

This contribution has been written by Dr Janet Owen on behalf of the English Civic Museums Network. Dr. Owen is founding director of The Earth Museum, a recently established not-for-profit company undertaking research and development into activities that connect people, place, collections and stories through the application of emerging technologies and creative practice. She is undertaking research into current work across ECMN members over the next few months, and would welcome the opportunity to discuss this further with the Geospatial Commission in due course.

Geospatial Commission: Call for Evidence Response Questionnaire
Environment Agency response

Key Issues

The Environment Agency makes extensive use of geospatial data and tools to underpin the delivery of our operational activities, meet our statutory obligations and manage incidents. Without these data and tools our place-based activities would be severely compromised.

We rely heavily on access to high quality, accurate and timely data including core reference data, base mapping, address and address look-up capability and detailed vector mapping which feeds into flood modelling or asset planning. This is complemented by the increasing availability of satellite and earth observation (EO) data from other government-lead initiatives such as Civil Contingencies' access to the Disaster Charter and Copernicus.

We have made significant investments in geospatial data and infrastructure over the last 20 years to make this data accessible to our staff. We have already contributed to delivering data for wider use and enabling economic growth by publishing geospatial data, such as LIDAR under an Open Government Licence (OGL), which has seen a huge surge in demand estimated at 2500%. We are committed to publishing more data as Open Data.

We are investing in this sector both as a consumer and a producer of geospatial data. There is some potential for our existing roles and relationships, as well as our ways of working and the data and tools available to us, to change with the development and implementation of a new cross-government Geospatial Strategy. The main issues we raise in our response include:

- The need to retain the range of data products, including access to high quality, content-rich mapping, available from the Ordnance Survey (OS) to support our core business delivery;
- Improved usability of the data including access, format, supply and data ready options to reduce the burden of data preparation and use;
- The need for data to be provided under licences that allow us to meet all our business needs, including sharing data with our partners and the public;
- Driving the identification and adoption of standards and best practice;
- The impact from any short term ambition to move from proprietary to open source GIS software in terms of resources and skills development;
- Increased joint working opportunities with the Geospatial Commission, their partners, government and wider business;
- Co-ordination of spatial data activity across government to improve efficiency and effectiveness particularly for the use of EO across government infrastructure with analysis-ready data easily accessible for use by all;
- Delivery of an innovation focus on UK satellite and launch capability for developing world-wide markets for UK companies. Promoting EO from small satellite constellations with near real-time data to unmanned drone technologies; and
- Working with UK Space Agency and commercial satellite imagery providers to leverage the best agreements.

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The boundaries of geospatial data encompass most public sector data – the distinction between geospatial data and other data need to be made clear. There is an opportunity to provide a citizen data service whereby citizens and interest groups could add their geospatial data to enable sharing of non-Gov. data as well, with all the caveats of Wikipedia etc.

Descriptions need to be clarified, particularly around geospatial and positional data. They seem to be split based on their purpose and mechanism of delivery. For example (3) is usually an attribute within (1) and/or (2) and covers master data attributes/register. Positional data already has a defined meaning in the dictionary and GIS world and there is not sufficient difference between meaning of (1) and (2), which could lead to ambiguity and confusion. As for (4), you could mean a product delivered through WMS or API or you could mean MasterMap, which could also fall under (1).

Data quality thresholds need to be established that enable the user to quickly understand the source of the data, its likely accuracy and any constraints upon its use. This would need to follow through into how the data is collected. Common standards have been established to underpin this linked data. Developing and promoting such standards is going to be key.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Staff who are well-versed and trained in geospatial skills is pre-requisite for the EA to undertake its functions otherwise we would not be able to use the increasing range and complexity of spatial data and systems to deliver our environmental outcomes. Geospatial skills need to be recognised as part of the mainstream skill set, with people trained (and that training maintained) wherever it is needed. The focus should be on the core data management skills that are widely lacking but underpin all subsequent use – geospatial and otherwise, e.g. data standards, stewardship, data quality assessments.

We also need high-end analysis of all types of spatial data, including EO, to enable the development of new applications and services. We need to be mindful of developing skills that allow the GIS discipline to integrate with other Science, Technology, Engineering and Mathematics (STEM) disciplines, e.g. statistics, data science, Earth Observation data, Artificial Intelligence (AI), deep learning and image recognition, so that we develop a culture of delivering at pace and failing fast if necessary. There is some concern that spatial data management attracts lower salaries than other areas of the data profession.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Geospatial approaches, tools and services have become a key enabler for the operations of the EA's business but the what is possible and the constraints is not uniformly understood. We can address these gaps by:

- providing access to suitable platforms for people to learn and develop;
- joining up with other STEM disciplines;
- undertaking spatial awareness training for basic GIS users to improve data quality, e.g. understanding how data being captured at different scales are not directly comparable; and
- Promoting a general wider understating of EO data including uses, advantages and limitations of remote sensing techniques, and knowledge for both applied techniques and intelligent understanding.

The timeframes for apprenticeships and levels are not necessarily suitable or appealing for people with 10 years 'on the job' experience. Shorter or equivalent Masters/PhD opportunities and mentoring would be helpful. Pushing apprenticeships in the external digital world would fill the gap in our suppliers/support partners. There are often skills gaps in geospatial technology in the IT delivery side of GIS.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We need access the data which is trustworthy, of the right quality and is provided by resilient services to undertake the EA's activities. Removal of barriers to accessing data from public and private bodies would be an important step in the development of the knowledge-based economy and would help drive the effectiveness of all organisations. We recognised the benefits of making our data available and publish data as Open Data wherever possible to make it as easy as possible for others to help us deliver environmental outcomes. Government could place a duty on all public bodies to make their data "open by design" and to make data freely and easily discoverable and available for use, under OGL wherever possible.

There is a lot of potential to go further to manage resources more efficiently by combining place data and consumption/release data. For example, enabling access to environmental data, and in particular environmental constraints upon business development, has the potential to be further improved. Currently such datasets are disparately distributed across different Government and non-Government bodies, and there could be a significant advantage to business and Government of pooling such data into a geospatial service.

Digitally-enabled cities could offer huge efficiency and quality of life gains. For example, by linking air quality data to dynamic traffic routing for example in order to keep air quality within safe limits. A proof of concept in an area of Manchester integrates data on public transport, car parks, air quality, and weather in order to reduce emissions, get drivers efficiently to a parking space, improve public transport times, and issue health warnings in real time to people with respiratory issues.

The commercial constraints on datasets can hinder access and use. Such datasets can be licensed for access so the data/projects themselves are not the problem, but the procurement process doesn't reflect that effectively the money is going from one Government body to another, which is an inefficient model of resource allocation. Improving intra-government body data sharing and licensing would reduce or remove some of this burden.

Other specific examples for the Geospatial Commission to consider include:

- The OS Water Network Layer should be available so it can be used universally;
- Soil mapping data;
- Data held by private bodies carrying out duties of a public nature, e.g. water companies;
- OS MasterMap - many unforeseen uses potentially releasing more value, with full OGL access;
- Address data, including Universal Postal Reference Number links;
- EO data, often difficult to access easily but improved infrastructure to aid access will help improve its ease of use;
- Several key infrastructure spatial datasets e.g. utility water, gas, electric for planning site visits, risk mapping and maintenance works;
- Land ownership and land boundary data but separated by use and available for reuse. For

example, Customer Land Database (CLAD) has ownership/contact information and County Parish Holding (CPH) number which is required for site visits and capital works maintenance. However, CLAD is split based on ownership and in some instances use;

- For environmental monitoring and soil composition we would benefit from an ecosystem approach so we need whole fields as represented by MasterMap boundaries not necessarily by ownership. 1 in 70 fields are represented differently across CLAD, MasterMap and satellite data;
- Robust Service Level Agreements (SLAs) are required to keep the information up to date;
- Any data in the Public Sector Mapping Agreement (PSMA) that aren't already Open;
- Citizen/Goodwill collected data – providing curation platform(s) to improve it would provide value going forward, especially if we do wish to encourage citizen science built on standards and quality; and
- The synergies with BIM and opportunity to link to data on infrastructure.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data are widely used and vital components of many EA activities. Without consistent and trustworthy address data we would need to spend more time and effort on recovering charges for regulated activities, and we would struggle to make effective plans for reducing flood risk. As a consequence the strategy should:

- Make key address identifiers Open without restriction;
- Integrate PSMA products with products like *what3words* and make them available for the new ways we want to work in the future, e.g. finding telematics (Internet of Things-IoT) devices
- Postcode is still a fundamental dataset for reporting and statistical purposes so maintaining or providing future open products that integrates this with address products must be maintained;
- Improve adoption of standardised address data, for example via APIs;
- Simplify addressing and look at the issue of multiple address databases for the UK; and
- Consider the z axis. Normally the best we get is z as a ground elevation but the representation of below surface elevations seems somewhat forgotten.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- Through provision of pre-processed, analysis-ready data and data services that enable discovery, metadata and re-use;
- Remove duplication of data processing and storage;
- Platforms that enable modelling and integration capability;
- Influence satellite suppliers to provide Analysis Ready Data (ARD); and
- EO needs to be centrally available across government, in one place and supported by a service manager so that it is easily accessible to use by all. The same resource could be open to all government and commercial users. Making the same source data available to both public and private sectors / markets will enable a step-change in interoperability and also create a level market in EO data.

The increasing rate at which technologies emerge will be a key constraint on the fitness and ability of the ecosystem and data to continue to both function and be of use. This extends to any remote

technology utilised to gather monitoring data such as sensors and transmitters. It is essential that such technology can communicate with the collection infrastructure and is capable of being upgraded as technologies improve. Are there lessons to be learned from the initial roll-out of energy smart meters?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

We envisage that new technology provides opportunities for us to process applications more quickly thereby reducing the time taken for developers to implement their plans for building houses, infrastructure or new businesses. The technology areas we anticipate being developed in the near future include:

- Data services, including data discovery, for all private and public information;
- Real-time and IOT data combined with EO data. IoT and real-time monitoring/feedback in terms of the potential of big data and secondary uses of the data in Artificial Intelligence. The functionality should be integrated into existing software that we use;
- Ensuring support for Augmented/Virtual Reality data for assessing planning, training and risk assessment through data services;
- Cloud-based delivery technologies for large datasets (EO) and analysis in the cloud with these datasets;
- Data appearing to be stored in one place; and
- Capability for analysis / modelling of data into new information through GIS/AI.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Standard geospatial data and analysis service mechanisms would support real time modelling and Augmented Reality technologies which could be used during incident response or to show the public what flood defences would look like once completed respectively. Identifiers would support information assimilation for technologies like Big Data and Blockchain which we could use as the basis of trading schemes.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We invest significant resources each year in creating, maintaining and sharing the data we use to make decisions on the environment, flooding and business efficiency. We have seen a significant increase in the use of our data since it has been made open for environmental purposes and for activities we did not originally consider. Options should include ways to:

- Continue to maintain and improve the quality and availability of public sector data;
- Work with partners to disrupt current ways of working and deliver innovative services and platforms to support information assimilation;
- Ensure adoption and transparency of discovery metadata, data flow mapping and quality of data;
- Place greater emphasis on standardisation and standardising formats;
- Make sure that organisations understand the data management principles that underlie our abilities to use both geospatial **and** non-geospatial data in efficient and effective ways;
- Consider established Best Practice for example OGC/WC3 best practice on publishing spatial data on the web http://www.w3.org/TR/sdw-bp/;
- Invest in the technology to enable/improve and maintain open access to these core

datasets;

- Harness the drive towards greater self–regulation and performance-based regulation provides opportunities for increased private sector investment in providing auditable data on their activities. Such data could contribute to maintaining and enhancing geospatial data assets, subject to it meeting defined common standards; and
- Support a fully telemetered river level and flow network which would give the public a huge amount of geospatially referenced Open Data on demand and enhance the value of the data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

All of these are required for developing and supporting emerging markets. We use the existing geospatial infrastructure for many of our place-based field activities such as supplying data and photographs of flood extents to our incident rooms using tablets or smartphones. Additional opportunities for GSC include :

- Develop small satellite constellations to provide near real time data to monitor the environment or assist in emergency response;
- Pursue unmanned drone technologies to include medium, large and high altitude systems; and
- Pursue remote sensing in support of groundwater assessment though much of this is experimental at the moment.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector can both deliver underpinning infrastructure and datasets and support government's delivery of them. They can provide platforms and applications but we need to define data standards so we are not dependent on specific bespoke applications. Those that are carrying out duties of a public nature, e.g. utility companies, have a particular role in providing access to integrated UK datasets that enable join up to public sector data and enable wider use.

The private sector can play a large role in contracting on the design, build and service provision. The role of the Commission / Public Sector should be to organise this as a co-ordinated activity for the national good. It could have a broker/curator role to manage other data as a "trusted source", reducing the cost to utility companies for example or using High Performance Computing (HPC) infrastructure services.

We should work with the private sector so we don't reinvent things they can do better than us already, e.g. https://toolbox.google.com/datasetsearch is now part of the spatial toolbox, but ensure we enable and feed into such initiatives so we can adopt them.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The challenges of integrating data from across the public sector is a significant inefficiency. When datasets and systems aren't interoperable data cannot be readily analysed without either significant re-work or duplication of effort. The Environment Agency's ability to integrate data from multiple internal and external sources allows us to get better insights into the environmental performance of individual regulated companies or sectors. In turn, these insights allow us to better target resources on interventions that will have the most impact on achieving environmental outcomes.

There are a large number of proprietary formats; enabling a wide selection of formats, including Open Source formats, allows wider use. Possible remedies include:

- Appropriate level metadata and licensing information. Access to this will allow us to use the right data and not just what we have to hand and ensure we understand the quality and appropriate use of the data. Understanding the licensing will ensure we are as open as possible. There needs to be a clear requirement for a few core metadata elements for location data, along with standards for these attributes, which are useful to end users in determining quality, and precision. Services could be created that document and alert users when they are assimilating information of different precision/quality. Local Authorities and the 3rd sector require support to allow them to easily standardise and leverage data with uniformity;
- Standardisation of formats;
- Highlighting examples of best practice to underscore why open formats are best;
- Making it as easy as possible for people to find geospatial data—one place to search; the benefits of data.gov.uk should not be lost but improved upon;
- Promotion of Linked Data standards which support interoperability; and
- For EO data, Analysis Ready data standards need to be agreed and adopted.

Whilst it is unlikely to be possible to align all data systems, it may be possible to utilise a core set of robotic processes that can source and access data from repositories across the public sector and to combine these into a geospatial output. An ability to use AI-type predictive analytics could further enhance this.

There shouldn't be any commercial component of our work with organisations such as BGS, CEH etc. If a government body has created a dataset all other government bodies shouldn't have to pay again to use it. Commissioning data is a challenge. Issues over capex and revenue for funding and Intellectual Property Rights (IPR) constantly create sticking points including claiming IPR for the work done by one public sector body even where funded by another body.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission could:

- identify the cross-cutting issues that require partnership across the public sector and possibly the private and third sectors, with a view to developing the necessary infrastructure to support partnership working;
- promote and support common and critical services that the public sector currently provides;
- identify and drive national standards at both metadata capture and sharing levels;
- develop guidance and promote best practice for data standards and consistent data services including reference data;
- drive alignment in strategy and consistency and interoperability in data; there needs to be clear mechanism, process and governance to do this;

- leverage the best commercial deals and make data available to all public sector bodies, i.e. purchase data once and facilitate easy access across the public sector; and
- for Earth Observation (EO) data working with the UK Space Agency, provide the best agreement with commercial EO satellite data providers.

There need to be groups and communities with representatives from the various organisations to influence, agree and sign up to standards and ways of working.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to that might have novel and valuable use cases? What would that access look like?

We already receive and use third party data extensively in our activities but there are a range for which we would welcome additional or improved access:

- Utilities data to support risk-mapping and maintenance activities;
- Land Parcels that are fit for different business use, i.e. ownership, environmental monitoring, enforcement, physical use of the land, soil quality;
- Personal data is a remaining barrier, for example, in accessing Customer Land Database and Food Standards Agency data; and
- Commercial Very High Resolution (VHR) satellite data under a single contract which gives us potential for more useful higher frequency data than, for example, aerial photography.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

By ensuring clarity of the data standards utilised by each administration.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Drive alignment in strategy, consistency, interoperability and standards in data; there need to be clear mechanism, process and governance to do this. There need to be groups and communities with representatives from the various organisations to influence, agree and sign up to standards and ways of working. For example, the Geospatial Commission should mandate APIs as data services and then lead a group to understand how to support LAs during implementation.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- LIDAR from satellite; and
- Taking UK-developed Earth Observation applications on natural resources to worldwide markets e.g. oil and gas, agriculture, forestry, water, natural resource disasters

Q18: Are there any other areas that we should look at as a priority?

- Managing incidents including data sharing;
- Ensure everything works on mobile devices, and that appropriate data services are available, e.g. Web Feature Services/Web Mapping Services;
- Natural Capital;
- Environmental pressures, e.g. flood risk, air quality, noise, light pollution;
- Social demographics;
- Sensorwebs - collection of various environmental and human health data, e.g. air quality;
- Data from these can be readily integrated and analysed with other spatial data including EO; and
- Collection of data from the public's mobile devices subject to personal privacy constraints.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

For any service that uses joined up geospatial data for citizen use or support public services, the regulatory issues include:

- currency of the data and being able to keep an audit of decisions and change to recreate and support evidence;
- Privacy – General Data Protection Regulation;
- Algorithms and transparency – who's really making the decision;
- Breaking down organisation silos and innovative ways of maintaining privacy while making sure the right data is available for use and is of suitable quality;
- Mobile working; and
- Building confidence for market scale use of devices.

A very helpful innovation for the public sector would be co-ordination and application of existing technologies across Agencies and Departments; there is some catch-up to be completed before taking on brand-new innovations.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We should promote our EO applications and services that have worldwide market visibility. We could invest in UK EO, e.g. space ports, satellites, data accessibility, 'drag and drop' into apps and core national dataset to enable world leading exploitation and development.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Open Geospatial Consortium would present a wealth of relevant information on Standards, Innovation, best practices, including:

Data on the web

Spatial Data on the Web

Look globally for imagery series purchased and operated by countries for natural resources.

EO Landsat series developed, owned and operated by the US government with many worldwide applications.

LIDAR in USA, Canada, Finland for forestry.

US data hub or Brazil/Singapore, with their smart cities, or Lithuania (as well as Croatia and Estonia) one of the most IoT connected countries in the world. We do great things and can take inspiration from others to innovate and do something that delivers for us.

United States: https://www.data.gov/

Lithuania: http://www.geoportal.lt/geoportal/web/en/e-services and https://www.geoportal.lt/service-order-webapp/views/grpk/serviceInfo.jsf

Austria: https://www.data.gv.at/

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Environment Systems Ltd
Job title	[Text redacted]
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E-mail	[Text redacted]
Telephone	[Text redacted]

About Environment Systems Ltd

Environment Systems is an established environmental and agricultural data company, providing trusted evidence and insight to governments and industry across the world since 2003.

The consultancy delivers bespoke advice and solutions for land management, monitoring and policy for ecosystems, natural capital evaluation, agricultural trials and agricultural supply chains. The company's satellite data services (https://data.envsys.co.uk/) deliver always-on, accessible open data insights from satellite Earth observations analytics.

Please select which of the following best describes you as a respondent:

Respondent	Please mark with a X
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	

Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The data types seems reasonable and practical.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The key areas of skills needed to underpin geospatial work are computer science (including knowledge of artificial intelligence, open standards, Open Geospatial Consortium standards and cloud computing), data science and data visualisation, all developed in the context of geographical understanding.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Environment Systems work in the UK and internationally. To ensure we have the very best talent and to improve our international opportunities we need to be able to recruit talent from both within the UK and internationally. For recruitment from within the EU, free and open movement of people is critical; for outside the EU, simple as possible visa criteria. Thus giving UK-based companies access to a skilled and motivated workforce, and giving the UK a competitive edge. This is particularly important for companies exporting and needing language skills and local experience/relationships embedded in the company in the UK.

In addition to the skills set out in Q2, application skills are needed. In the case of Environment Systems this is in geography, environmental science, agriculture, ecology, natural capital. These skills drive the requirement for and set the context for geospatial skills.

Commercial skills are key to enable the development and implementation of new business models especially in relation to data, where there are challenges over communicating the value of data, especially in the context of open vs closed licencing or free vs paid for access.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There are key enabling datasets that underpin geospatial work in the UK, including Ordnance Survey MasterMap and high resolution digital elevation models. These data should be made available under a free and open licence.

Key datasets for environmental and agricultural applications including the rural payment agencies (all UK countries) field parcels, soils data (originally publicly funded but privately held and licenced by Cranfield University) and Met Office weather data. These data should be made available under a free and open licence.

Environmental and agricultural applications would benefit hugely from a reduction in siloed data, duplication, and use of poor equivalents (or no data) when making key decisions. These benefits would be more readily realised if these underpinning, infrastructure, datasets were free and open for commercial use, and supplied in an open standard, with supporting standardised metadata.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data are not an area Environment Systems has expertise in. We are occasional users of the data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Earth observation (EO) includes imaging from satellite and airborne (piloted and drones). Systematic piloted airborne imaging is a highly mature market and there is niche use of piloted airborne for applications sitting between satellite and drones; neither of which are covered here.

In raw form satellite EO is complex and expensive to handle. Sythetic aperture radar (SAR) is a highly complex type of EO. Both optical and SAR EO need processing and preparation before they can be turned into products that are classed as 'analysis ready data' for a specialist user or 'ready to use' for the less technical user. The commercial market is well served to deliver both these types of data. One example of an analysis ready data system is Environment Systems

Data Services https://data.envsys.co.uk/.

UK government should be buying more EO and EO-derived products from UK industry. They need to buy EO-derived data products that perform a task and deliver benefit and not simply focus on buying methods and pilot projects. EO projects in government that never operationalise are starting to harm the industry by causing confusion over technology and service readiness.

Government need to signpost other areas of the public secor (e.g. local authorites) as to how EO can be used as a cost-effective tool to support their parts of their regulatory obligations and service delivery.

Publicly funded EO centres should have clear UK plc goals and operational defintions with associated funding. They should not have post-funding sustainability goals that then drive quasi-commercial behaviour and confusion in the market.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The key developing technology for geospatial is artificial intelligence (AI). There is considerable hype around AI and the commission could play a key role in helping to define the realistic and demonstratable on-going role and value of AI. AI is powerful in many applications but it is not magic (e.g. as is sometimes portrayed in EO applications), and is often at its strongest when performing a specific role as part of a wider processing chain, rather than being the solution on its own. An example is in producing a land-cover map from a satellite image where the use of machine learning can help to map specific land covers very well, but often not a comprehensive, complex (multi-class) map, which requires other algorithms and/or human intervention to complete.

Using distributed public blockchain as means of ‘proof of location’, and to satisfy clauses in smart contracts has great potential benefit for location-based services.

Linking EO with the immutable nature of a distributed public blockchain could also be applied to agriculture or forestry supply chain; aiding with certification and supporting the Sustainable Development Goals.

The scalable nature of commercial cloud technologies offers the potential to better exploit global EO data capture from Copernicus. The public sector should better embrace open source software which supports open data standards, rather than proprietory software which can end up siloing data in closed formats

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The value proposition of geospatial data and applications is as a digital infrastructure that uses geography to enable other applications e.g. environmental, agriculture, transport, health. The use of open licenced data in standardised open file formats, with supporting standardised metadata have key roles in delivering this.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The public sector should not get directly involved in innovation (outside of policy innovation) as the sector is generally slow to function and very risk averse. The public sector should look to the private sector for innovation and buy services off the back of it. It is critical for industry sustainability and for new innovation to look outside the Geo Big6 for this.

Identify new sources of R&D funding (including future Innovate priorities and post-H2020 options) that will support the geospatial sector and enable industry and public authorities to collaborate and develop new technologies, intellectual property and products.

Agree long term operational funding streams for the public sector, that do not mean proprietary 'lock-in' but a commitment to enable data driven decision making. This should include promoting the use of G-Cloud as a procurement route for public sector buyers.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Keep them switched on and up to date. Maintain access to the Galileo system.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Environment Systems is a downstream provider and operates in the environmental and agricultural markets and does not have a particular view on the underpinning infrastructure as long as it is maintained and is free and open and includes involvement of the private sector i.e. from outside the Geo Big6.

For the UK as a whole, the private sector should develop and maintain the skills required for the geospatial sector, and be allowed to exports its services without competing with the Geo Big6.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Environment Systems has worked closely with the UK public sector for over 15 years and is highly experienced at using public sector geospatial data and in producing geospatial data for the public sector. In summary public sector generated data can be of indeterminant quality, and supplied in inconsistent formats, with or without metadata. Likewise, their requirements for how the data are supplied to them varies greatly.

Clear guidelines (and supporting training) needs to be giving to the public sector, demonstrating the cost saving to be made by using open file formats, and standardised machine readable metadata (e.g. OGC/ISO standards in xml).

The mandatory use of a publicly viewable data catalogue(s) where there is a level of transparency as to what data each public sector organisation holds would greatly reduce duplication e.g. https://data.gov.uk/. This does not mean the development of a data portal with complex viewing and/or analysis tools.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Help government users of geospatial data to develop institutional knowledge of the data that are held in the public sector to ensure that it is not just understood by individuals who may move on and then that knowledge gets lost. All government departments / agencies / etc should be mandated to view all data (including geospatial) as an asset and should protect and manage that asset as it would any other.

Public sector data should be released as open data using open standards to let others connect to it for private and commercial use.

The Geospatial Commission should ensure that the private sector is well represented to balance the Geo Big6 and their day-to-day access into the public sector.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

To realise the value of the new wave of EO (especially from the Sentinel satellites) these data need to be accessible via easy to use, reliable channels. Examples such as the Environment Systems Data Services can enable this https://data.envsys.co.uk/ giving access to weekly analytics for the UK under an open data licence, with standardised metadata.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

If a single UK strategy is needed, it will still need to recognise, link and build upon devolved administrations strategies.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Mandate the use of open data licencing for all data produced by the public sector (with only clearly defined privacy and security related content being the exception). Make supplying and receiving data in open standards formats mandatory for all local authorites. Make local authorites publicise the metadata for all their datasets.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Focusing on natural resources, the key applications for scaling up are:

a. National identification and monitoring of natural capital assets and associated valuation. This will help recognise the role of our environment and the goods and services that it provides us for free, so that we don not have to engineer and pay for a solution for it e.g. pollination, natural flood management, carbon storage.
b. Data driven decision making in agriculture from sub field to national scale. Agriculture 4.0 is underway and the sector is starting to address a lot of questions that the geospatial community either already has answered or can help in developing the answer to. Increasingly farming at scale is done remotely with little inherent connection to the land; to succed this requires data-driven decision making.

We welcome the opportunity to discuss these applications further.

Q18: Are there any other areas that we should look at as a priority?

Supporting export of the UK geospatial capability (see Q20 answer).

Develop an investment environment that supports UK start-ups and scale-ups (with focus on scale-ups) that want to grow, want to stay in the UK and want to raise small to medium amounts (£1-5m) and not just the unicorn sums. There is currently a lot of investment appetite and capability but it is aimed at large deals.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Flying drones Beyond Visual Line of Sight (BVLOS) operationally needs to accelerate to deliver on their expected benefits in agriculture and natural resource management. BVLOS is needed due to the requirement for economies of scale over large areas of land. BVLOS solution(s) need to be light touch and low cost.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK geospatial industry needs access to international markets (including EU) with ability to trade with international governments and businesses. This is important for growth and resilience.

Strong, regular briefings to Department for International Trade (DIT), DIT advisors and UK embassies around the world on the UK geospatial capability. These briefings should focus on UK businesses, and for research capability on UK universities, not just on the Geo Big6 and Catapults due to their existing connections in government.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Whilst looking at the competition is useful it should not be the driver for defining the UK strategy, which should be defined based on the market (public and private sectors) requirements and the UK capability.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

ENVITIA

DISCOVER > ANALYSE > ACT

Geospatial Commission Call for Evidence Response

Envitia Ltd, [Text Redacted]
Registered in England No. 2348404

Envitia Inc, [Text Redacted]

Section 1 Introduction

About you and your organisation

Name	[Text redacted]
Organisation	Envitia Ltd
Job Title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	X
Micro business (up to 9)	
Other - please state	

1.1 About Envitia

Envitia has been instrumental in research over 15 years leading to the development of the Ministry of Defence's spatial data infrastructure as well as being a key contractor in its delivery. Envitia also has supplied open, geospatial standards compliant technology throughout UK government including to the Welsh Assembly, Rural Payments Division Wales, the Land Registry, Registers of Scotland, the Valuation Office Agency, the UK Hydrographic Office and the Met Office.

1.2 About the Authors [Text redacted]

Section 2 Responses

2.1 Q1 - Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Data, both open and proprietary is already heavily siloed in terms of scope, format and application. Individual data sets are also rarely used in isolation and are often aggregated and/or derived and transformed and/or reformatted.

Constraining the definition of what constitutes a geospatial data type persists the view that this is specialised data which requires specialist knowledge and expertise to consume and use.

Geospatial is a key context to most data and whilst geospatial data can conform to one of these 3 categorisations, most data sets exist outside of such a narrow definition and often exhibits more than one of these categories.

2.2 Q2 - In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Whilst a good understanding of the principles of Geographic Information Systems (GIS) is valuable in advancing the goals of the Geospatial Commission, the use of geospatial data in a web context, and in relation to other, not directly geospatial, data requires an additional set of skills. This includes skills in the design, use and implementation of web services and web services infrastructure, skills in web application design and development, general software engineering and broader data science skills. The mindset and skills needed to develop geospatially enabled applications is broader than those required to exploit a GIS system. Ensuring that there is a wide range of potential geospatial exploiters who understand Geospatial Information (GI) technology and thus integrating training in GI into the more general web development programmes would be helpful.

2.3 Q3 - What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Organisations can have a tendency to polarise into either data centric organisations or technology focussed organisations. For example, Envitia is very much a technology focussed organisation but has a firm understanding of geospatial data. However other small organisations do not have the financial resources to cover every aspect of a problem space. For example, organisations such as the UK Hydrographic Office and Ordnance Survey have an extensive skill bank in producing attractive map visualisations. The Commission could provide a vehicle, or broker, for organisations to access skills which are not easily available to organisations exploiting national and international Spatial Data Infrastructures (SDIs).

Another key issue is that the skills that are specifically related to SDI as opposed to GIS are not recognised as a distinct discipline in academia; whilst AGI represents the community there is no professional membership related to this domain. Professionals split typically between RICS for more GIS related biases and IET for technology biases and thus the creation of a specific professional recognition would be a useful and beneficial step.

2.4 Q4 - How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

Do not prioritise any given data set over another. It is almost impossible to predict what data set will be useful and what will not. Instead let the end users of the data decide. Prioritise sharing of data sets in open and easily consumed formats and invest in maintaining those data sets that are regularly accessed and used. Ensure that high-quality metadata is available for all data sets that detail quality metrics, legal and security constraints and target usage, so that consuming applications can readily identify which data sets are appropriate to use in their particular scenario.

Other European SDIs that implement the Infrastructure for Spatial Information in the European Community (INSPIRE) directive have shown that the INSPIRE Annex I and Annex 2 themes are broadly used and so implementing the effective delivery of Annex I and II themes offers an excellent starting point; these provide, amongst others, addressing, cadastral parcels, grid systems and transport networks. Despite the ongoing political situation around exiting the European Union, INSPIRE still represents the current best framework for an SDI; it is used by many other countries and by the United Nations Global Geospatial Information Management (UN GGIM).

2.5 Q5 - Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The current pricing and licensing model for UK addressing data that is based on or contains Postcode Address File content is a barrier to uptake and to adoption, particularly for start-ups and for SMEs. The number of efforts to provide an alternative source of truth for addressing data, including Free the Postcode, Free Our Data, Open Postcode and Open Addresses underpin this. Compare and contrast the pricing matrix for the Ordnance Survey Address Base data products with the 2010 Danish program of releasing that countries addressing data as open data, which has been stated to create yearly economic and social benefits valued at circa €14 million.

Equally, the example of the Netherlands Publieke Dienstverlening Op de Kaart Loket (PDOK) project is significant. The Netherlands have opted to provide a government funded, mixed government and commercially supported SDI, which includes a large-scale topographic map similar to the Ordnance Survey's MasterMap. This SDI is used throughout government and commercial organisations and in 2017 it received over 6 Billion hits for geospatial.

2.6 Q6 - How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Satellite based remote sensing, both multi-band imagery and terrain profile information, offers a wealth of potential. Yet existing sources offer very poor access services to Earth Observation (EO) data. Application developers are almost always compelled to sign up with one of the specific platform suppliers, for example Digital Globe, to have any chance of exploiting EO data effectively. The commission could force a more open model of access, similar to that of the European Space Agency (ESA) Heterogeneous Mission Architecture (HMA) approach. This provides effective data discovery, access to EO products in a consistent way and the ability to deploy algorithms near to the data. In addition, efficient integrated, multi-scale, high resolution orthoimagery and terrain layers for the UK available as a web service would be extremely valuable.

2.7 Q7 - Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

While humans find visual imagery useful, computer software requires vector or object-based data (i.e. intelligent geo-data). Whilst traditionally this data has been captured using classic survey techniques and cartographic processes in organisations such as the Ordnance Survey, this is giving way to more automated mechanisms. Uber, for example, re-map the road network of major cities, such as New York, several times a day. Social media, suitably anonymised, is capable of delivering vast amounts of geospatial data. To support these processes:

- Deep learning around all forms of crowd-source data is important.

- Enable exploitation of the many sources by better information integration technologies.
- Create policy which allows the effective exploitation of such data without compromising individuals.
- Automated quality control which allows both crowdsourced and authoritative data to be intrinsically and extrinsically validated.

2.8 Q8 - How can geospatial data and applications be used to support enhanced roll-out of future technologies?

A key benefit of good foundation geospatial data is that it means exploiters of that data are not required to undertake activities which are not key to their business and instead can concentrate on adding value. The UK Met Office needs to provide mapping data over which its weather data is overlaid in order to present an effective forecast visualisation. An effective SDI with guaranteed Quality of Service (QoS) means this organisation can rely and depend on the underlying map and therefore concentrate on weather overlay delivery.

As with any platform, the goal is to make development of new applications easier and make those applications more accessible. Apart from data availability, geospatial data exploiters also suffer from the problem that data comes in far too many types, formats, content models as well as via multiple access portals and under wildly differing licencing models By providing a consistent environment, standardised data and access terms, the SDI can dramatically reduce the cost of exploiting geospatial information by all, including academia and industry, both of whom are the source of future technologies. Organisations such as the Open Geospatial Consortium (OGC) are critical to the development and uptake of data standards and whilst they may not be perfect or be visible to the consumer, they are vital at a governmental data exchange and interoperability level.

2.9 Q9 - What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Section 4 of the Call for Evidence document, entitled Enhancing the UK's Geospatial Assets, celebrates the UK's knowledge in producing geospatial data. From the point of view of delivery though, we would suggest that the UK is one of the least effective. Unlike many European countries, the UK cannot in any way claim to have an effective SDI.

Government will find it difficult to fund large scale investment in data delivery in the current economic climate. However, the Netherlands has invested in deploying a broad spatial data infrastructure to reduce costs in government and support innovation in the private sector.

One aspect which is critical for government to address is the area of managing standardisation to avoid single vendor dominance, whether it is by ESRI, Google, Microsoft or another commercial vendor. Government can also enable a more balanced ecosystem by in effect managing the geospatial storefront, for example by offering an effective catalogue of data, of services delivering these data sets and of applications using this data. One only needs to look at the effectiveness of the App Store approach in the mobile industry in enabling innovation to see the benefit. 'Platforms' are the modern approach to achieving innovation. If Government does not take the lead, it is very likely that this will polarise to a single vendor solution.

Finally, high-quality maintained metadata is important for consumers to understand whether the data assets are fit for their particular purpose.

2.10 Q10 - What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

It is clear that we are moving to the need for geospatial data - or more correctly geospatially enabled data, i.e. not *geodata* per se but *data* as discussed in the response to Q1 above - with much more precision and accuracy. There will be a move from 2D data to 3D data because of all sorts of application demands, for example autonomous vehicles, indoor navigation, 5G network optimisation and so on.

This needs very high precision, and therefore real time positioning, using multiple technologies. Both research and infrastructure commitments are needed to deliver the level of, sub-centimetre, precision that is required. Ordnance Survey already have an effective national geodetic network, supported by fixed devices and airborne mobile references. Smart building *may* in the near term provide such robust references for internal navigation, but such information may be considered commercially sensitive. The growing level of capability in mobile devices does allow each person's phone to be a sensor if this was acceptable to the manufacturers, the mobile networks and the consumer; if they are both protected and benefit from the engagement (by better data) it maybe more palatable to them. This is once again an information integration and governance problem to deliver what is very clearly an information resource.

2.11 Q11 - What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Government should set standards for geospatial data and services and support the delivery of foundation geospatial data, in particular providing data and service catalogues, but should leave industry to provide added value services and market specific applications. The private sector can also provide technology to support the generation and integration of foundation geospatial information, based on the strong base of government data such as OS MasterMap. With its high-quality geometry and persistent identifiers, MasterMap is a good framework to build business specific information on top of, if MasterMap was delivered as a government supported transactional source rather than purely a download. In addition, the build out of full 3D urban mapping from this is an endeavour that should not to be left purely to government.

2.12 Q12 - Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As discussed in the response to Q1, data has historically and continues to be siloed. This occurs at multiple points in the lifecycle of data production and dissemination.

The three main areas where uptake can be increased, and usage encouraged are at the point of production, availability of high-quality metadata and in the manner in which the data is formatted to be shared.

Individual data products often originate from one or more data corpora, wherein the data to be released is produced as a subset of the originating corpus. In doing so, valuable semantic linkages and related metadata is lost. This is due to bias on the part of the originating organisation who owns or manages the data corpus in assuming the intent and use cases that the data in intended to satisfy.

Data products require high-quality machine-readable metadata, at the point of discovery. This must be beyond the simple title and bounding box properties, so that consuming applications can understand legal and security constraints, target use cases, quality metrics and associated limitations. GEMINI2 (UK.gov) and MGMP2 (MOD) provide starting points for this at the data sets level but will need evolving into richer data sets beyond the pure foundation geospatial data sets. Eventually, elements of metadata need to be available at individual feature level for quality assessment in such circumstances as composite data sets made up of conflated multiple data sources – some authoritative, some crowdsourced.

Furthermore, the data format in which data is transformed into often adds another siloed dimension. Data is often transformed into a binary format, by which the originating data is effective opaque and for which a reverse transformation into the source data cannot be achieved.

Wherever possible the intent and use case for data should not be assumed and the data released in a form which preserves as much of the original corpus as is possible.

Additionally, the format in which data is released should prefer a plain text format, which allows easy use, examination and subsequent transformation according to the end user's needs. This is not to say that some data should not be released in a binary format, such as in the case of raster mapping products, but the original source data from which the raster was derived should be made available in parallel. Furthermore, delivery of data in multiple formats is easily achieved at the server and platform level and all public sector data should use a set of textual data formats, such as GeoJSON, KML or GML, consistently across all platforms and points of access. The goal is to make it easier for client application development (which in turn drives innovation and enterprise).

2.13 Q13 - How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The creation of an effective environment to allow data and geospatial data providers and consumers to collaborate should be a key goal of the Geospatial Commission. This should involve technology, policy, and socialisation and training. A key goal of the Commission should be to understand and promote the potential value of the National SDI. The Commission needs to engage existing organisations such as the Ordnance Survey, UK Hydrographic Office, Met Office, DEFRA and the Land Registry. The Commission should also support an extensive programme of promotion to ensure the market understands the benefit. Supporting a range of proof of concepts relating to different domains will also start to show the broad value of an SDI. Finally, sponsoring governmental projects to adopt the SDI will help industry focus on integrating with this.

2.14 Q14 - Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Before considering additional data sets, the UK should concentrate on continuing to deliver the themes covered in INSPIRE Annex I and Annex II. The current UK delivery of these themes is via bulk data download rather than via transactional information access. In effect true *online* access is not widely available for UK data compared with other national SDIs and we believe that this is a major barrier to adoption, uptake and use. As a result, Government and private sector organisations are still deploying their own foundation geospatial information.

In terms of additional data sets, at least two other nations (France and the Netherlands) have progressed from foundation data provision to look at effective delivery of sub-surface data. Similar initiatives are in place in the United States. This information includes geological information, as well as physical infrastructure such as that present in cities. This information can provide highly significant benefits in support of a number of sectors, not solely limited to Utilities.

1.1 Q15 - How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Any strategy needs input from all stakeholders. And these come from Government, the private sector and from academia. All three of these need to be included in both policy development and underpinning implementation, technical and procedural works. Expecting free participation is likely to result in only large organisations engaging. This is unhealthy for diversity and the overall economy. Funding organisations at a number of levels, on working groups, in pilots and capability development programmes will significantly enhance the openness, democracy and fairness in the SDI.

1.2 Q16 - How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Continuing of the theme of avoiding dominance from the cohort of big system integrators, if Government sponsors and funds implementation of SDI enabling systems rather than silos this will encourage more organisations in Local Government to engage. Some years ago, the UK Government funded the Urban Traffic Management and Control (UTMC) standards programme, opening up information from traffic systems and providing grants to local authorities to implement it. This allowed them to overcome the vendor lock-in in that major traffic system vendors were trying to achieve and thus enabled strategic traffic information exchange across and between counties for the benefit of all. This model seems most appropriate to the UK SDI. Additionally, the work undertaken by the Defence Geospatial Information Working Group (DGIWG), which is supported by both the UK and the US Defence sectors, provides a valuable exemplar in key data modelling, including that of INSPIRE.

1.3 Q17 - As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified: property and land, infrastructure and construction, mobility, natural resources sales and marketing. What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

While not immediately economic in nature, as the key developer of the UK Defence Spatial Data Infrastructure, which is very close to operational deployment, we are surprised that there is not more emphasis on integrating defence and civil resilience geospatial information. Demonstrating how this bridge can be made to work - and the standards involved are common to both military and civil communities - would improve UK resilience and also be a shop window for sale of technology to other nations particularly those in emerging economies. Given the pressure on policing and the rise in crime, approaches, both technology and policy based, which exploit technology to detect threats and crime would seem an obvious application area to us.

On a more commercial theme, lessons drawn from the intelligence community which now uses position and time to correlate information from different sources, offers the ability to deliver much more advanced business intelligence in a range of sectors. This approach is generally known as Object Based Intelligence (or OBI) and the principles are widely applicable across many domains and fields.

1.4 Q18 - Are there any other areas that we should look at as a priority?

A major activity should be to review best practice in other countries and develop design implementation patterns for the UK SDI. We also strongly recommend a first step of

establishing an effective geospatial service (data and processing) catalogue and registration ecosystem to, at a base level, provide a self-generating audit of UK geospatial capability. To a limited extent data,gov.uk provides this but it really needs broader stakeholder input to deliver an effective catalogue. It should not be a geospatial catalogue but at least an effectively geospatially enabled catalogue, which we would argue that the current data.gov.uk offering is not.

1.5 Q19 - What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

It will be impossible for systems such as autonomous vehicles to operate without continually improving geospatial information. It will also be critical for continued improvements in public transport which will have to come. 5G network technology is highly directional and without high quality 3D city information it will be impossible to provide an effective service. Augmented Reality (AR), which has numerous potential use cases, has significant potential benefits in a wide range of applications, but detailed, sub-centimetre precision geospatial information is needed for it to work effectively; at present this level of information does not exist.

1.6 Q20 - How best can we make the UK's presence in the international geospatial world more visible?

In our opinion by having a world class SDI, involving all three stakeholder groups, government, industry and academia. The Netherlands PDOK SDI has generated a massive amount of interest and benefit for the Netherlands. Whilst we can have a more commercially based offering if we choose to do so, some elements not limited to standardisation, the central catalogue and policy, are elements that make an SDI which we need to show works. In our opinion current policy is too driven by a few government organisations, such as the Ordnance Survey, who have too significant an influence on policy and implementation.

1.7 Q21 - Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

As stated in the response to Q20 above, the Netherlands PDOK SDI, with strong funding and supporting organisation (GeoNovum) is a good model. The French and German governments both also have effective National SDIs. Outside of Europe, Canada has an effective SDI as do some specific cities in the US, although overall support in the US is patchier. The Geospatial Commission should also look to the work undertaken in UK Defence which has resulted in a primarily Open Source based SDI deployment, in the face of a previous dominance of specific vendor systems such as ESRI and Intergraph. While not completely operational yet, it is set to transform the way the Defence sector does business in relation to geospatial information. It also has 10 years of research, experimentation and standardisation and policy development to draw upon and offers an effective geospatial marketplace allowing external vendor systems to integrate easily.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Esri Ireland BCS, the Chartered Insitute for IT
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The view of geospatial data types is accurate although I believe there is too much ambiguity around type 1 and type 2. Giving examples for each would make it easier for individuals to differentiate.
For instance where does deprivation measures, addresses, mobile location, IOT sensors fit.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I believe that although many organisations are now using GIS in their daily operations, it is in most cases still only pockets of the organisation. It is not yet fully pervasive, due to a lack of awareness of the potential of geospatial information and technology to really drive strategic business decisions. I believe the commission should focus on raising the profile of geospatial across the public.

Where we are seeing an increase in data scientists across the public and private sector, this career in the most part does not seem to include the importance of geospatial analysis. Again the commission should looking at raising the profile of geospatial amongst a number of professions including data scientists. Potentially looking at the exisiting university courses to ensure geospatial is part of a number of courses hitherto have not included it. It should not just be taught in Geography and GIS courses.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As a Geospatial technology company I do not believe we have any gaps in our organisation.

However we do face an increasing challenge in the recruitment of skilled staff here in Northern Ireland.

Having worked in the public sector and now the private sector in the field of GIS and geospatial technology and data, I have found a consistent issue with a lack of understanding in the capture of spatial data. Data collectors, not always understanding why they are collecting something, or the fact that it needs to be in a certain format to make it easy for a GIS system to easily read it. There needs to be an education piece around data standards and metadata – it is important to know when the data was captured, what the data holds, what the quality statement is etc.

Esri has an initiative called ArcGIS for schools – which in NI means that every primary and post-primary schools has access to use our Software as a service offering in the classroom. https://schools.esri-ireland.ie/
This initative will ensure that teachers, parents and school children get at least an awareness of the possibilities of geospatial data and technologies. Working alongside curriculum bodies and Education departments to ensure that geospatial is part of the curriculum will go along way to promoting careers.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One data set that has been discussed by our customers time and again is access to a broadband, mobile coverage for Northern Ireland. One complete dataset showing, broadband, 3G, 4G, 5G, public wifi, including who the providers are. This currently can be created by going to each provider and paying to get the information. However this is costly to customers. This would be a great dataset to have as it would help government in relation to where to invest next in infrastructure, it would help us promote NI to tourists, and it would help smart city projects and start ups.

Making Pointer (which includes Royal Mail PAF information) free would greatly increase its adoption across Northern Ireland to ensure we have a consistent, up to date accurate address base for properties in Northern Ireland, with a unique identifier that would allow data sharing across organisations. (see Q5 for more information). The use of the UPRN could then be mandated when sharing location information across NI.

In Northern Ireland the Land Registry data is difficult and expensive to access – unless you are a solicitor you have to visit an office and request information on a case by case basis. This data should be more easily accessible (even at cost) via a webservice.

NISRA (Northern Ireland Statistics and Research Agency) data is not readily available as geospatial data. This is a key dataset for schools, for businesses, and for the public sector. In Ireland the Census office has published all of their statistics as a open data inconjunction with Ordnance Survey Ireland boundary data. This greatly enriches the statistics and allows users to quickly and easily search for information on a map. http://census2016.geohive.ie/

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

In Northern Ireland we have the Pointer address database, managed by LPS and fed back Royal Mail, local councils and valuation. This dataset has UPRNs and USRNs from the NLPG.
https://www.nidirect.gov.uk/publications/pointer-technical-specification
However the format of Pointer does not directly match the NLPS standard and is not BS7666 compliant eg. Pointer accommodates Townlands.
Having a consistent address format across the UK would make it easier for UK wide initiatives.

Currently Pointer captures the location of a building based by collecting the

position using x,y coordinates. However more and more we are seeing a need for the z or third dimension as more use is made of BIM etc.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Be bold, share your data. Ask for feedback, crowd source.

If a you are out an address to value it, to review it for building control compliance etc. make sure the address is accurate if not feed it back.

Make it easier for everyone in the public sector who completes site visits to feedback to the central address database (in Northern Ireland that is Pointer).

Change of workflows to mandate the creation of geospatial information at source as a crucial part of the process, not an add on or after-thought.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should be a key partner with the public sector in the development and maintenance of the underpinning infrastructure. The private sector has the skills and capabilities to work along side the public sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Understanding from the providers – why are we producing/collecting this data? Do we the producers know/understand why the end user/customers needs the data?
Data standards, similar to coding standards eg don't use key words, ampersands, commas; should be mandated.

The creation of a UK Geospatial Hub (GB& NI) where anyone can go in search of data – not necessarily host the data but have links to or reference the data from the source providers. Ability to search by location, via a map. Access to live feed of data, rather than a one of cut of data.

INSPIRE – this is overly complicated, make it simpler to understand and provide a easier mechanism for sharing data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Instead of every organisation have to buy PAF, can the Commission negotiate and manage the PAF contract for all public sector (GB & NI)?

The commission should focus on the encourgaging collaboration and sharing of geospatial data across departments.

The commission should look at how geospatial can become part of the curriculum in GB and NI.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Look at ensuring that there are a few key objectives that should be pervasive across strategies:
e.g. Data sharing is the norm not the exception
e.g. Metadata to be provided for data sets – eg. Who, when, accuracy, currency
e.g. Creation of common language across strategies – to ensure common understanding across the regions and to enable better communication.

Please note that Northern Ireland has a separate coordinate system to GB.
Please note that Northern Ireland has a different central address database to GB.

The creation of a UK Geospatial Hub (GB& NI) where anyone can go in search of data – not necessarily host the data but have links to or reference the data from the source providers. Ability to search by location, via a map. Access to live feed of data, rather than a one of cut of data.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

National/Regional Standards for data capture to ensure that data can be shared easily among local authorities. Eg optimising bin collections etc.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Smart cities, smart regions

Citizen engagement – better, quicker access to data and information based on your location.
Allowing the public and private sector to be pre-emptive rather than reactive – the supplier of services should know of the problem before the customer eg. Water leakage causing loss of water to a neighbourhood.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Investing in Education including research & development in relation to geospatial. Make the UK the place to come if you want to work in the most cutting edge economy for geospatial.

Look at competing on an international stage.
ESRI User Conference – this is held every year in San Diego. Special Achievement in GIS (SAG) Awards are given out each year and both Northern Ireland and GB organisations have won repeatedly.
https://www.esri.com/en-us/about/events/uc/sag-awards

Support charities that are working across the world on tackling global issues.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Look at other exemplars in different disciplines eg. Cyber Security.
Northern Ireland is the worlds #1 destination for US investment in cyber security. We have the UK's leading university cyber security research centre here at Queens University. There are 60 plus companies here. There was investment in this area from the government, there was the creation of a hub.
https://www.nicyber.tech/
https://www.qub.ac.uk/csit/

http://unstats-undesa.opendata.arcgis.com/
Geospatial technology being used to report on the United Nations Sustainable goals.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission
Cabinet Office
1 Horse Guards Road
London
SW1A 2HQ

24 October 2018

Dear Geospatial Commission

RE: National Geospatial Strategy Call for Evidence

Thank you for publishing your call for evidence and for providing the opportunity to respond to your questions. As well as answering the questions, the team at Esri UK wishes to highlight key factors which we believe to be of importance to the Geospatial Commission in achieving the ambition of unlocking the potential of geospatial and delivering economic return.

Geo-enabling the nation

If the UK is to truly unlock the economic value of geospatial, sustainably and for the long term, then we must geo-enable the nation. Geospatial techniques are currently taught, almost exclusively, to geographers and GIS professionals. The geospatial approach is applicable to almost all information management use cases. We recommend that the Commission focuses on the approach to geospatial in education, outside of its traditional niche.

Over that last few years, progress has been made, with the introduction of Geographic Information Systems into the school curriculum. Esri UK has welcomed this and now supports schools across the UK with free software and educational resources.

As this geo-aware generation matures and enters further and higher education, and the world of work, the continued investment in their geospatial skills is vital.

It is Esri UK's vision that every new entrant into a public-sector role will have geospatial skills development built into their induction and ongoing training programmes; that university degree courses, from business studies to social care, economics to epidemiology and more, will routinely include geospatial; and that every computer and data scientist will learn why spatial is special.

A long-term geospatial skills strategy for geo-enabling the nation will be welcome priority from the Commission.

Spatial relationships rather than spatial data

Throughout the questions in the Commission's consultation, references are made to geospatial data. However, a great deal of what would be categorised as non-spatial data include spatial components; components that allow spatial relationships to be made between diverse sets of

data. Spatial relationships are powerful, unlock understanding that is hidden, and inform greater insight and action. We recommend focussing on both geospatial data and all data that contains spatial references.

Releasing value

There are numerous companies across the UK and the world, with a variety of business models, producing a plethora of software applications in the field of geospatial. These companies will continue to innovate and evolve new technology now and in the future.

As the Commission invests in geospatial, the focus should be on innovative use cases and should avoid reinventing existing capabilities or subsidising business as usual.

Elevating the value of GIS across Government

Whilst the last decade has seen significant growth in the application of geospatial across the UK public sector, use remains limited and the value is not well understood. Only a fraction of Government leaders appreciate how geospatial data, analysis and dissemination can provide robust evidence to inform decision-making. This prevents the UK public sector from fully realising cost reduction, increased efficiency, transparency and the empowerment of citizens.

We urge the Geospatial Commission to prioritise elevating the value of geospatial at all levels of Government, especially with leaders who are best-placed to effect change and realise benefits for the UK.

Broadening stakeholders

Since its inception, the Commission has engaged well with the geospatial community in both the private and public sectors. However, it is Esri's view that a much wider stakeholder group exists.

The geospatial industry has a proud record of innovation and has, in recent years, embraced emerging technologies such as cloud, smart devices, the Internet of Things and more to provide new analytical techniques, insights and value.

There has also been interesting innovation from other parts of industry. One such example is "What 3 Words". Created by a mathematician and a musician, What 3 Words, seeks to give every location and, by extension, every person on the planet, an address. This geospatial innovation was conceived outside of what can be thought of as the geospatial community.

We encourage the Commission to engage with the widest range of stakeholders, within and beyond the geospatial community to fully unlock the potential and create the maximum economic return.

Avoiding costly mistakes

There have been several geospatial projects in recent years, undertaken by UK public sector organisations, that have been very costly, have overrun and in some cases failed entirely. This has arisen mainly due to the lack of suitably qualified personnel with sufficient geospatial skills and understanding, to execute the projects effectively. This leads on to the next point.

[Text redacted]

Optimise Addressing

Rooftop level and multiple occupancy addressing is currently fragmented and tangled up in public and private ownership. Addressing is a fundamental underpinning dataset for exploiting geospatial techniques and optimising our economy and society. Any progress to simplify access and improve consistency of addressing will bring benefits to the UK.

Too many boundaries

Government funds services at a national, regional and local level. However, various parts of the public sector use different geographies. For example, health boundaries are not coterminous with local authority boundaries, which are often different again from fire and police. This makes it difficult to understand clearly the characteristics of any one place in a consistent manner.

Our recommendation is to mandate the use of the small area statistical boundaries, as defined by the Office for National Statistics, as the building blocks for all public-sector geographies. In doing so, analysis and targeting of resources will be improved, leading to reduced cost and increased efficiency in delivering services.

Once again, we thank the Geospatial Commission for the opportunity to respond to the consultation and offer Esri UK's continued participation in further dialogue.

Regards,

[Text redacted]

[Text redacted]

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Esri UK Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**

Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instil best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Esri UK finds your view of the data types broadly accurate, with the following observations.

a. The distinction between 1 and 2 is more of a spectrum than a binary distinction and is somewhat qualitative.

b. The descriptions of the types do not give clarity. Giving a list of examples would help your audience get a better grasp of the distinctions, for example:

   i. Satellite imagery, river network, road network

   ii. Land registry parcels, utility assets

   iii. Postal Addresses

c. When we discussed the examples that fit your categories we got into debates about which was which. This reinforced the opinion that the "types" are a spectrum.

We do not suggest inclusion or exclusion of other types, rather we note that the value of a geospatial approach is primarily realised by the exploitation of spatial relationships in business and societal systems. The availability of geospatial data is an important aspect

of this.

However, there is a risk that focusing on the provision of the data will result in a lack of awareness and development of the full potential. This is an area that other spatial strategies have missed or underplayed. The UK has an opportunity to lead in this area. Esri UK would like to explore this with you.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Esri UK recommends that geospatial skills need to be much more widely spread across both the public and private sectors rather than concentrated solely in the traditional geospatial community. The data science and analytics disciplines do not make enough use of geospatial techniques, primarily due to the lack of education and awareness in these areas.

Any university or college course that covers information management, data science or data analytics should include modules on geospatial techniques and use of spatial relationships. For example, Information Management, Marketing, Business Administration, Psychology, Criminology and Computer Science are all degree courses that should include a substantive element of geo-learning – perhaps best defined by the ability to demand, identify and realise the contribution of geo into these specialist areas.

This gap in geospatial skills and understanding is also present in the UK school system. Geospatial can be used across the curriculum but is seen as a niche area for geographers, despite its application to science, technology, engineering and mathematics (STEM) and arts and design (STEAM). This view is supported by the Royal Society in its July 2018 publication 'The integration of data science in the primary and secondary curriculum', recognising the importance of geo in data science.

Although the use of geospatial data and skills is mandated for all secondary school children, there is a disconnect between the government Education Department and the agencies that hold the geospatial data that is specified in the curriculum. There is a huge opportunity to connect these two areas of government to improve the education outcomes around geospatial and related areas.

As a user group, schoolchildren and teachers are the UK's largest collection of geospatial users. Despite this, they are significantly underrepresented in the decision-making process around access, type and usability of geospatial data. There is a big opportunity to focus on nurturing enthusiasm and curiosity about all things geospatial to secures its UK future.

Without necessarily realising it, the wider population is increasingly exposed to geospatial data and applications in their professional and personal lives. Through organisations such as Uber, Google Maps and Waze, there is a growing demand for access to and provision of location data to support decisions about where to go and what to do. If we increase geo-learning, this demand will grow even more. Businesses can take advantage of this appetite if they appreciate it and bridge any gaps in geospatial capability – they need to

regard geospatial capability as a core capability.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As a leading geospatial solutions business, we do not have geospatial gaps in our organisation – we train our own people, who are dedicated to promoting wider and better use of geo.

One challenge for us is that the pool of people educated with geospatial skills and understanding from which we can recruit is small. Consequently, we incur high recruitment and training costs to develop geospatial experts. Whilst this "home-grown" capability helps us to distinguish ourselves in the market, it does not help the wider UK to expand and extend its geospatial ambitions.

Another challenge is that we find the vision and understanding necessary to take advantage of geo is lacking in our customer base; when the "intelligent customer" is missing, we spend time and effort educating rather than realising tangible business or economic benefits.

A broader understanding of the value that geospatial data and geospatial analysis has to an organisation needs to be developed within the senior leadership of public and private sector organisations. Too often, these discussion take place at junior levels, with people who are less informed and concerned about delivering core strategic business outcomes. This situation perpetuates the tactical use of geo data and limits opportunity.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There are four areas that we find challenging:

- High-quality addressing data: the private and commercial nature of the Postal Address File, and the complexity in the ownership of addressing across the UK, results in complexity and expense for us and our customers.
- Historic maps of the UK and related overseas UK activity: these would have significant education value but, even where they are available, copyright and

commercial sensitivities stop them from becoming widely accessible.

- A coherent rivers and catchment areas dataset: this would have high valuable to schools. It is a mandated area of study about the UK, but the data is difficult to access, and in the case of rivers, there is a not a centre line dataset that is continuous in one segment from source to mouth.
- Geospatial meteorological data: this is also difficult to access because of licensing, copyright and usability of the data. Again, the study of UK weather is required by the National Curriculum.

If these datasets were made available, they would be used by every school in the UK.

We also note that many available geospatial datasets suffer from variable quality and completeness, but do not have the supporting metadata to be able to assess the extent of this. Achieving the relevant quality therefore becomes a demanding task for many organisations.

We have also observed that the Maritime sector is a large and sometimes undervalued component of the UK economy both direct and indirect. The potential for the UK government and business to further exploit the opportunities in the maritime environment is significant. A small number of examples of potential include: minimising environmental impact; fuel efficiency; risk assessment (insurance); security; autonomous navigation etc… and it's good to see UKHO listed as one of the partner bodies.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Standardisation of address identifiers across all address products is essential. Address data should be geospatially enabled at its creation and maintained to a national standard in a consistent national address register. It should as freely (commercially and practically) available as is feasible.

The National Land and Property Gazetteer (NLPG) has a standard, but local authorities' interpretation and application of this standard varies. As well as having the NLPG, authorities often still maintain address databases for other systems, such as social care, non-domestic rates and council tax, which are not always joined up, which causes duplication and error.

It is encouraging that the Geospatial Commission intends to work with GeoPlace, the Local Government Association (LGA), the Improvement Service (on behalf of Scottish Local Government), and Ordnance Survey (OS) to investigate how best to open the key identifiers, Unique Property Reference Numbers (UPRN) and Unique Street Reference Numbers (USRN), together with their respective geometries for the whole of Great Britain under Open Government Licence (OGL) terms.

Access to other address contributors, such as Postal Address Files, should also be looked at, as this is a crucial component to addressing. And, addressing data needs to be easy to access and consume, through Application Programming Interfaces (APIs) and web services.

Restricted access to key identifiers has long been an issue for local authorities; they have responsibility for creating addresses via street naming and numbering function but then do not 'own' the data when a postcode is assigned.

Standardisation of identifiers and a consistent national address register will bring value through better integration between systems, less manual effort on maintaining multiple address databases and greater adoption. This will benefit many organisations and initiatives, including emergency services, census and retail delivery services.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK already has a thriving Earth observation market supported in part by the UK Space Agency. This ranges from world-leading scientific expertise in the building and deployment of satellites*, their sensors and ground segments, to re-use of Earth observation data to support a broad range of needs, such as:

- Sustainable development including environmental monitoring and policy, urban change detection and planning enforcement
- Weather forecasting
- Science and exploration
- Navigation
- Security and defence

The immediate Earth observation capabilities required to bolster this market are three-fold:

1. Better understanding of Earth observation data sources, and their applicability to public sector and commercial business needs, at senior levels.
2. Sufficient availability of the technical skills required to appropriately use Earth observation data. It is one type of geospatial data that can be incorporated with other spatial and/or non-spatial data alongside data analytics capability to produce new insights, understanding and cost savings.
3. Greater awareness and access to existing technologies that support access and re-use of such data (Satellite Imagery E.g. Sentinel 2A and 2B create 1.6Tb of data per day by themselves).

The initial focus should be on how we maximise the opportunities afforded by existing (for example, Landsat and its long-term temporal archive) and new (for example, Sentinel

programme) Earth observation data.

***** Including the first all-British radar satellite, Nova SAR

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Given our previous observations on the low levels of understanding of geospatial data in its raw and applied forms, Esri UK encourages focus on widening basic skills and use of existing well-developed technology. We counsel against adding new technology to solve a problem that is people-based.

When and where geospatial capability is established, and available technologies are delivering tangible benefit, there are opportunities to extend to new technologies [Mobile, AI, robotics, virtual reality and others)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The appropriate application of geospatial techniques to future, and indeed current systems, can help reduce the fundamental complexity of these systems. Spatial relationships can be used to reduce design complexity, improve maintainability and offer scalability.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Making it easy to capture and maintain quality spatial data

The creation and administration of geospatial information can be challenging and lead to a lack of availability of data and consistent quality. This increases cost and complexity, and limits sharing. There are techniques for achieving this that we should apply. We are happy to engage further on this if needed.

Adding and maintaining location to Government data

In the course of its operations, the Government collects a great deal of data. Whilst much of this data is not categorised as spatial data, it commonly includes some locational factors. For example, address, postcode, grid reference, postcode district, ward, local authority area, health boundary, county or country.

Government should continue to collect this type of data and, where it does not exist, add locational aspects to the data and make them available for use within and beyond the public sector.

Over time, this will increase the volume and quality of location referenced data and the value of the Government's spatial data asset.

Government contracts, data maintenance and data intellectual property

Government lets many contracts for services, delivered at a location. For example, roads maintenance, refuse collection and care packages. Contracts rarely require the contractor to maintain data or to provide it back to the Government as part of the contract deliverables.

Without this valuable data, the Government is losing the opportunity to reduce the cost of managing assets and projects in the long term; to provide useful insight into the how much value for money the contract is achieving; and to improve future efficiency or drive innovation within and outside the public sector.

For example, providing quality data to the private sector during a tender process allows bidders to understand in detail the opportunities and "cost the risk" when bidding. This results in sustainable bids with lower contingency costs that offer better value to the Government.

Creating new spatial data assets from existing Government data

Spatial data is collected by many organisations across the public sector. The Environment Agency and the Scottish Environment Protection Agency (SEPA) maintain terrain models covering much of Great Britain. OS maintains the country's national mapping asset. Various parts of government hold asset data for building, the built environment or land ownership information.

To generate increased value from these various data sets, they should be combined to create new spatial data resources. For example, a 3D basemap for the UK, which could in turn be used by planners, flood risk modellers, emergency planners and others to improve ways of working.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Esri UK recommends prioritising:

- Improving infrastructure accuracy: the existing GPS infrastructure provides reasonable accuracy for many emerging requirements for spatial data. However, its accuracy is restricted because of the limited availability of Differential GPS information and the complexity of its use. This is often limited to post-processing of the data, restricting high-accuracy use in real-time situations.
- Improving access to Differential GPS: the Ordnance Survey "OS Net" system provides a combination of free, premium and partner Differential GPS services. We recommend consideration of how to make Differential GPS information such as OS Net more easily consumable by public and private sector organisations and by the public.
- Exploiting Artificial Intelligence (AI): for example, AI could be used with a phone's camera and other sensors, combined with GPS to enable sub-meter, sub-second location anywhere in the UK. GPS provides rough location; the AI refines it via computer vision. This is highly feasible with today's technology. It would require a large investment and focus, but would be a high profile, engaging project that would attract international interest and open many opportunities.
- Increasing availability of geodetic data: the UK is increasingly well-covered by a Geodetic network based on the mobile cell towers. It makes sense for the private sector to continue to deliver this with the Geospatial Commission taking responsibility, through a combination of legislation and agreement, that positional information from this network can be used.
- Exploiting roadside infrastructure: many transformational emerging applications such as self-driving cars will benefit from or require high-accuracy positioning delivered by roadside infrastructure. Some of this infrastructure is being delivered through existing initiatives such as the Smart Motorways programme. The Geospatial Commission can take responsibility to ensure that any positioning infrastructure and data delivered through this programme is accessible (with appropriate security safeguards) to the wider public and private sector, and that it can be integrated with other UK geospatial initiatives.
- Preserving Earth observation data post-Brexit: data such as that delivered by Copernicus is increasingly useful in applications such as environmental management and geographic economic analysis. It is essential that access to Copernicus and related programmes is maintained post-Brexit.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector will have a role to play in both the development and maintenance of both the infrastructure and geospatial data assets, but the specific role will vary on a case-by-case basis.

The main roles for the private sector are:

- Provision of products and technology to support the use of geospatial techniques and data. Crucially the ease of use and accessibility of these is key to unlocking the value for wider society
- Expertise in geospatial techniques and their use across government and society
- Infrastructure for the use and sharing of geospatial data and techniques

Even for critical national infrastructure, the skills and capabilities of the private sector are required, to work alongside Government to deliver the capability and capacity needed.

The private sector also brings innovation and are continuously enhancing their products and services offerings based on the requirements of the market.

For example; In keeping with its position as a leading GIS software provider, Esri has the largest research and development (R&D) budget in the industry, spending 30% of its annual revenue on product maintenance and enhancement.

Esri's product development teams collate requests and ideas for changes and enhancements to the ArcGIS product portfolio based on a series of inputs:

- Customer feedback from the Esri Ideas website, user conferences and other forums.
- Technology changes, for example, operating system upgrades from industry standard vendors such as Microsoft.
- General technology innovation, for example, 3D, mobile devices and cloud models.
- Industry-related technology innovation, for example, new metering and monitoring.
- GIS industry changes such as standards from the Open Geospatial Consortium (OGC) or the ISO TC/211 series committees.
- Legislative changes, for example, data protection.
- Feedback from the technical support helpdesk relating to issues raised by customers.

The teams have a routine process to regularly assess the requests and ideas and discuss them with local technical teams in the Esri distributor and partner community, before prioritising them into a roadmap.

Esri UK has a close working relationship with the Esri teams and strongly represents its extensive customer base in these product discussions.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges are less about technical solutions and more about the varying quality and standardisation of datasets across the public sector. In some cases, these are perceived challenges that stifle the release of data by Government. For example, departments can be unwilling to release their data due to:

- It not being captured consistently over time
- Poor quality data assurance processes
- A fear of what reputational or organisational damage providing poor quality data might cause.

In response to these objections, we observe that the ODI and other Open Data advocates would not consider these concerns sufficient to not release the data as Open Data.

There are technical remedies to data quality issues such as data-cleansing tools. These are unattractive as they can be time-consuming and manually intensive. Instead, the Geospatial Commission and public sector should be using technical toolsets to cleanse data as it is created. For example, by enforcing data standards and business rules at the point of capture.

For any technical solution to be effective, there needs to be a standard against which to capture the datasets. It is not necessary or practical to enforce the same standard on all datasets but having consistent quality within an individual dataset will help with departments have confidence in sharing and using it. It is important to make the data accessible so that users have the chance to work with the data, which will inform how and where effort should be placed on improving quality or creating standards.

Geospatial data is unique in its nature because it allows to bring together disparate datasets together via the common framework of location.

There are organisations in the public sector who generate and maintain lots of data which would be categorised as non-spatial data but include spatial components; components that allow spatial relationships to be made between diverse sets of data. Organisations often make this data available via spreadsheets, reports, static maps etc. Spatial relationships are powerful, they can unlock understanding that is hidden, and inform greater insight and action. We recommend focussing on both geospatial data and all data that contains spatial references.

The use and usability by schools should also be considered when the public sector is releasing new data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

As noted above, many senior leaders fail to appreciate the value of data and the technologies to exploit that value, even when the technology exists in their organisations.

The Commission will ideally take an outward-looking, enabling role. You will build an understanding of why senior stakeholders are not leveraging the value of geospatial data, broadening your stakeholder communities beyond those directly involved in geospatial work and beyond the geospatial industry.

A key role for the Commission will then be to run a programme of awareness and education with senior leaders throughout the public sector to help them:

- Understand the value of geospatial data and a geographic approach to policy-

making, monitoring and delivery.

- Collaborate and share geospatial data across departments.

This work can be extended to “geo-enable the nation” through upskilling the public sector on how to exploit geospatial data. This includes learning and skills within schools, as well as under graduate and post-graduate courses. Having a Commission representative that is responsible for linking the geospatial community and the education system would be a positive step.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We recommend the following:

- A national 3D basemap, with terrain to 1m, or lower, 3D buildings and object to LOD2 (as a minimum), openly available on the same basis as MasterMap.
- Datasets such as Earth observation data and aerial imagery and satellite imagery such as Sentinel 2. Sensed data has the potential to be valuable to the public sector as it can provide a constant update of data which can be used to create new statistical outputs or as a proxy for statistics that are otherwise time-consuming to create and have long time gaps between releases. Imagery analysis can support our understanding of changes over time through, for example, urbanisation, deforestation and risk of flooding.
- Geographical hierarchies from the Office of National Statistics (ONS) are important to map public sector data by areas although the Government creates too many boundaries on which to apply data. Rationalisation of these boundaries could provide a saving to Government as well as consistency on which to use for specific purposes.

Aside from the partner bodies, the Commission can also consider the range of data that is available from industry partners. An example from Esri is the Living Atlas of the world, which holds curated content from Esri and customers providing access to authoritative and user-created content.

https://livingatlas.arcgis.com/en/

Access should take the form of services onto this data, so users can access them at source and not have the burden of downloading the content which then must be managed and maintained. A good example of this is the ONS Open Geography portal, which serves out geographical datasets as Open Data for users to consume via an API.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Initiatives of this nature can fail through over-complication. Esri UK recommends keeping a single UK strategy as simple as possible. Ensure consensus by defining the scope with the devolved Governments and with the GeoComm 6. Focus on key principles:

- All data is shareable unless there is an ethical or legal reason not to.
- Data characteristics, including quality, standard and format, are not mandatory before sharing - sharing is more important, maybe with a signposting system to indicate currency or accuracy.
- Be a shop window for geospatial data available from Government.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Local authorities need to receive value from the data they produce and share, otherwise there is no incentive for them to contribute effectively. If authorities can see that the data they provide is giving them back valuable data – for example, in the form of UK-wide, standardised data that can then inform their own planning and business decision - then it becomes in everyone's interest to provide good quality data through coordination and sharing best practice.

Effective collaboration between Local Authorities and Government is also important. Location data can be catalyst for collaboration. Bringing together data from all sectors builds an asset that no single organisation could create and supports devliery of better public services.

There is a role for national standards (alongside policy and other types of coordination). For example: the standardisation of transport data collection and sharing protocols could assist the development of national travel applications and the ability for developers to understand planning constraints in different areas.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Geospatial capability and applications exist within each of these listed industries and the geospatial industry is quick to make an impact on new industries, for example, the growing UK viticulture industry in the South of England.

In Esri UK's experience, it will be challenging to develop a methodology to successfully identify the most appropriate existing or potential geospatial applications that could be scaled-up or developed to capture economic value. Our view is that the development of such geospatial applications should be left to the free market, based on supply and demand with little or no government control or subsidy.

We welcome the Geospatial Commission's support for the geospatial market to thrive. There are some broad factors (highlighted in our covering letter) and specific requirements (see below) that would significantly bolster the geospatial industry's potential to realise economic value:

1. Return on Investment/Cost Benefit Analysis (RoI/CBA): The Geospatial industry is historically poor at evaluating the RoI/CBA (including social benefits) of a geospatially enabled approach. Investing in a robust, high-quality socio-economic study for a range (perhaps ten) of geospatial enabled projects (for example, using Treasury's Green Book methodology) would provide considerable benefit to the whole industry. It would provide geospatial suppliers and users with independent verification of the benefits that can be realised and thus would support the elevation of the value of geography across Government.
2. Data Standards: as described in our response to question 16. As noted, a more standardised data landscape, for local authorities and central Government, would support the interoperability and exploitation of Government data for use within spatial and non-spatial applications for economic benefit.
3. Citizen Engagement: the technology now exists to enable citizens and volunteers to play an active and valuable role supporting charities, not-for-profits and Government bodies. Citizen science has long been lauded but, outside the charity sector (where we see increasing usage), uptake is slow and constrained. Geospatially-enabled technology can support citizen participation in data-driven discussions about public policy and to partner on initiatives. We recommend creating sustained two-way community engagement as an approach to drive economic benefit, improve the public's satisfaction and trust in Government, and improve performance, efficiency and cost savings.
4. Collaboration: Government data still sits in silos. The drive for Open Data, started by the Government's Transparency Agenda in 2010, made some positive impacts in releasing large numbers of previously restricted datasets. Unfortunately, the urgency of Open Data publication appears to have waned over the past few years. Nonetheless, the potential for data-sharing is high and, whilst certain data cannot be released openly, it could be shared securely to meet specific aims, such as supporting vulnerable individuals or creating more effective, joined up services. However, Government bodies are reticent to collaborate with such data, even with other Government bodies, as they do not have appropriate skills and processes to approve such data-sharing and are unaware of solutions that allow them to do so securely. Significant cost savings and performance improvements can be enabled through improved collaboration, as indicated through the proliferation of Offices for Data Analytics.

Q18: Are there any other areas that we should look at as a priority?

We consider education to be the highest priority. If the UK wants to unlock the potential of geospatial, there needs to be a step change.

Most initiatives to date across the world have focused on data standards, data availability and clever projects within the existing industry. No country has tackled what we consider to be the main block to realising the full potential - the awareness and usage of geospatial techniques across all of society.

Geo skills needs to be taught as fundamental alongside other common information management approaches in, for example, engineering, data science, architecture and statistics.

The local education authorities across the UK need to be connected to the other Government agencies that can help them deliver better education outcomes based on geospatial. This would include developing the geospatial understanding and its role in our society for key staff in the education departments.

Over the long-term, an investment in this area would create an environment where the benefits of increased access to geospatial data could be realised.

One way to champion the subject would be for the Commission to pick a high-profile area that has suffered from a lack of spatial understanding and help tackle it – become the sponsor and intelligent customer in a way that shows quick value and efficiency. Rural Payments is a prime candidate for this.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We have identified the following areas of potential innovation:

- Improved Town Planning and Local Development processes
- Citizen engagement. E.g. Citizen Science, Consultations and Volunteer Programmes
- Transport efficiencies, especially multi-modal
- Application of remote sensing approaches to issues such as fly-tipping
- Crime reduction
- Societal efficiencies for example using location to optimise employment, commute time and quality of life.

Whilst not a regulatory challenge, there are cultural factors such as; data owners reluctance to share data, which will need to be overcome.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

To develop an international presence, we recommend:

- Developing a brand identity for the Geospatial Commission coupled with high-profile initiatives and concrete steps. The MasterMap announcement is an excellent first step and OS is an internationally well-respected organisation with which to associate.
- Make waves in the education arena by moving beyond pure geography and expanding teaching of geospatial techniques across many subject areas including data science and business courses.
- Tackling global issues through high-profile projects that attract interest, such as illegal fishing, disaster preparation or coping with growth.
- Exploiting new technology in a high profile, high value manner; a moonshot project that would establish our leadership in the geospatial.

  For example, AI could be used with a phone's camera and other sensors, combined with GPS to enable sub-meter, sub-second location anywhere in the UK. GPS provides rough location; the AI refines it via computer vision. This is highly feasible with today's technology. It would require a large investment and focus, but would be a high profile, engaging project that would attract international interest and open many opportunities.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Throughout the Commission's questions and our responses, many areas have been identified for which overseas exemplars could be sought. We recommend that it is important to categorise the areas for improvement and map international initiatives appropriately. Categories include:

- Skill development and career enhancement
- Datasets
- Technologies
- Development of infrastructure
- Role of private sector
- Strategy development
- Coordination between central and local government
- High-value categories:
  - property and land
  - infrastructure and construction
  - mobility
  - natural resources
  - sales and marketing
- Applications

There are many examples for these areas individually but not one complete exemplar for all. As mentioned in the response to Q18, no country has tackled what we consider to be the main block to realising the full potential - the awareness and usage of geospatial techniques across all of society.

The creation of the Geospatial Commission brings an opportunity to “reboot” the role of geospatial to support government, business and society.

As a leading player in the global geospatial market, Esri and its international partner community are aware of interesting exemplars that are emerging:

The Singapore Government is collectively working toward the objectives outlined in their Smart Nation initiative. This visionary policy is recognised globally as one of the strongest and most innovative smart government initiatives. A foundation element of Smart Nation is geospatial information and technology underpinning many of the supporting projects across multiple government organisations and citizen projects. Singaporean government agencies including National Parks, Land & Transport Authority, Urban Redevelopment Authority, Housing Development Board, Singapore Police Force and the Singapore Land Authority are working with Esri Singapore on these projects focused on achieving Smart Nation objectives. The projects apply enterprise-wide geospatial technologies within and across multiple government agencies. Esri Singapore is committed to working with the Singaporean Government on broader initiatives including education, Open Data and start-up ecosystems to further deepen Singapore’s long term geospatial capabilities.

A number of European countries have developed and are implementing national geospatial strategies or their equivalents, often as part of broader government strategies related to Open Data, eGovernment or Digital transformation.

For example, Denmark published its “Good Basic Data for Everyone – A Driver for Growth and Efficiency” report as part of its eGovernment strategy. The basic data includes a number of geospatial datasets (topographic mapping, addresses, property (land parcel) information) made available as open data. Once the strategy is fully implemented the benefits to the Danish society are estimated at 800 million DKK per year (around £95 million). The real estate, insurance, financial, and telecom sectors, as well as GPS (sat-nav) manufacturers, public companies and entrepreneurs were identified as the main beneficiaries. More recently, the Danish Government has published its Digital Strategy for 2016 – 2020 for “A stronger and more secure Denmark”. Ongoing quality improvements to the basic data is a key initiative within the strategy.

The Netherlands is another good example of a European country which has a well organised approach to geospatial data through its National Spatial Data Infrastructure programme with the goal of building a ‘location intelligent government’. A well-established governance structure, facilitated by GeoNovum (the equivalent of the UK AGI), and clear legal framework (including the definition of so-called ‘key registers’ and an open data policy) provides the framework for the public, private and scientific communities to collaborate around geospatial data.

In summary, in the last five years, a huge amount of progress has been made in opening up geospatial data, with impressive statistics around the number of downloads. For example, the online portal of the Danish National Mapping Agency (SDFE) – Kortforsyningen - received a record 4.5 billion data requests during 2017. Private companies are now using SDFE’s data in new and innovative ways, and it is evident that geospatial information creates added value for the users in many applications. Some recent use-cases relate to buying real estate, renting city bikes, assessing the risk for burglary, and illustrating the geospatial distribution of tax rates.

We can provide reference to the above if that would be of interest.

Open Data is the first philosophical shift, but still not enabling geographic knowledge to be pervasively available, usable or integrated into the way decisions are made and processes and systems run.

Insight can be gathered from existing industry reports and publications. Two recent examples include:

GeoBuiz 2018 industry market report and country comparative assessments

UN GGIM Integrated Geospatial Information Framework

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Experian
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Fundamentally, geospatial data is the description of where an action takes place – whether it be the location of a person, a business, a transaction or an object. For businesses, having a set of common global standards is increasingly important. For consumers, having a simple way to convey, use and understand those standards is also critical – especially in an increasingly 'on demand' world.

We agree that your broad description of geospatial, positional data and identifiers is correct. Clearly the services element (part 4 of your definition) will be the area that the private sector can most contribute to by adding value to the base geospatial data produced by the six partner bodies (and others).

However, whilst it may be inherent in Part 4 of your definition, the Commission needs to ensure proper consideration of data about geographical areas, and not just geospatial 'point' information. This then feeds into ensuring that, for example, there is proper focus on a robust, on-going UK Census, creating baseline information for all organisations, both public and private and individuals about the fundamental demographic characteristics of areas. In line with this, the discussion of standards should apply to both point and identifier information and geographies in a wider sense.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Experian believes that in the context of the ever growing focus on consumer data over the last 10 years, there is a need to re-tell and reinforce the story we already know around the importance, use and governance of geospatial data. Over the last 30 years, many organisations have been founded on the basis that analysis and management of geographic data is central to their activities. There is also a huge range of academic research and material on this topic.

At a time when concerns regarding consumer data privacy and associated regulation are rightly being discussed, we believe there is an opportunity for the Commission to re-invigorate the messaging around the importance of geospatial data as a tool to address key issues and problems.

The Commission has a key role to play in explaining to a wider audience that geospatial is not new and unknown data but rather is something that has been used for decades.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

With the complexity of applications and underlying geospatial data comes a need for skilled staff. These skills are at a premium as some of the skills that had existed have been lost as organisations take different strategic priorities and more could be done to train staff to use GIS packages. Additionally, more should be done to make geospatial data available in commonly used formats that can be integrated into more software and thus used by more developers and staff. As we have seen with the democratisation of data more widely, it is the usability and accessibility of data and tools that increases the benefits for businesses and consumers. We would encourage all the agencies involved to consider interropability and accessibility when producing data – removing barriers to use should be a major focus area.

The Commission should ensure that there is a recognition that geospatial data, in all its forms, can inform digital communications and can play a key role in creating relevant digital advertising for consumers and for public service messaging.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The changes being made to MasterMap access are a potential step forward but is important that the proposed changes are applied consistently to all organisations in the sector and that existing users, whether large or small, are not penalised or restricted. These changes to be accompanied by changes to OS derived data rules which impact the data of other agencies such as the HMLR (with INSPIRE Polygons a good example). Public datasets built in conjunction with or hosted by private bodies should also be examined (with examples including OS Points of Interest) to ensure that access is open to all and pricing is set at an appropriate level. A good example of where this has changed is the residential and commercial EPC data now being Open.

Fundamentally, as much publicly owned data as possible should be made open to all and we support the approach taken by the Open Data Institute and the case made by the now defunct Open Data User Group in their papers on the National Information Infrastructure.

We would also like to mention the risks to quality posed by the privatisation of national information infrastructure such as Royal Mail PAF. It is crucial that these assets are maintained effectively, with sufficiently independent oversight (such as the PAF Advisory Board and OFCOM) and ideally that datasets of such national importance are owned by the public for the benefit of the public and made open of restrictive commercial licensing. We would temper this by commending the Royal Mail (and their advisory / regulatory partners) on their efforts so far to make PAF more widely and easily available to the public sector, charities and SMEs.

The same will be true of data managed by the OS, HMLR and other agencies.

Perhaps the best way forward would be for the Geospatial Commission to take on a role similar to that of ODUG – making the case for data to be released openly for the benefit of the nation. For this, they will need stakeholders representing various interests and the support (financially and so on) of Government to succeed.

There are some specific examples of public datasets which are challenging to use but which can deliver value, particularly in the property sector. The quality of VOA data and the ability to match it to other sources is a challenge. A range of other property data for example from HMLR and Local Authorities can also be useful but are inconsistent and hard to match and use. The application of a consistent property identifier such as UPRN or a standard addressing format would make the combination of data a much more straightforward process. These datasets combined can create far more value than using each individually.

As a member of the Market Research Society's Census and Geodemographic Group, Experian would also point the Commission to the response of that group in relation to any access and quality issues with regard to Census data.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The UK postal address and postcode system has been developed over a great number of years and the introduction of the postcode has been a huge benefit to the efficiency of the postal service. It (and the underlying data) have also become useful in a range of applications far beyond the routing and delivery of a letter.

The postcode is now shorthand for so much in the day to day lives of people that it needs to be easily integrated into existing and emerging technologies – whether it be ridesharing apps, drone deliveries or registering for a bank account – the postcode is a good way to get 'close' to the relevant location.

With the rise of digital services, the way we communicate location is also changing – whether it's a 3 word address (such as runs.lives.luxury) or the location of our device in Latitude and Longitude, the services we use will need to be able to handle and link multiple location standards.

Therefore, the existing address data should be made interoperable where possible with other standards and in a way that is accessible. For example, whilst CodePoint Open gives a free grid location for a postcode, it is not in an international standard (the British National Grid is not the same as Lat/Long). Also, if you require the grid reference for a property, you need to purchase an additional dataset on top of PAF (such as OS AddressBase). The costs and complexities of this are challenging to businesses and software service providers alike.

We are also anecdotally aware of some cases where different agencies in Government have used different address standards leading to confusion and potential detriment for consumers. One such case involved a local electoral office using the Gazetteer version of an address instead of the version returned to them by the voter on their registration form (as per the regulations around voter registration) which happened to match the PAF version. The consumer later claimed that this error resulted in the refusal of a credit application. Whilst we have not been able to validate this claim as our address matching functioned correctly, we have been able to see that the Gazetteer and PAF version of the address could be different enough to confuse some basic address matching solutions created by 3rd parties. It needs to be clear which address standard should be used for which purpose and agencies should be educated as to the risks of not following agreed regulations and best practise. To resolve this completely, a single address standard available to both public and commercial entities at a low (or zero) price would be favourable.

Finally, licensing needs to take into account the changing nature of data use. Royal Mail have already made good steps with their Per Click licensing model for PAF and we would like to see the Ordnance Survey and other agencies match this model where they have commercially sold data. This will reduce administration and make data easier and less expensive to access. Data holders should also consider whether a post pay model is more appropriate (rather than buying bundles of clicks up front). Licensing must also be consistent irrespective of an organisations size as both SMEs and larger organisations can create and deliver new applications for the market.

As a member of the PAF Advisory Board, we would also draw your attention to the recommendations made by them.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We have no comment on this question.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are a number of new technologies already established in the area of AI and Machine Learning and these technologies are proving effective in the analysis of individual-level and micro data. Therefore the role the Commission could play in this area is to examine how to leverage these technologies to incorporate geospatial data where relevant to a specific problem. This could be as much about adding breadth to the types of data analysed and leveraged by existing technologies, rather than looking for new technologies.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

We have no comment on this question.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

With the assumption that publicly owned data should be open (and free) by default, the focus should be on funding organisations to continue to provide (and enhance) high quality base level data through the tax income from that onward use of data within services, apps, software and so on.

Whilst the base level data should be free, organisations could examine charging for additional services such as APIs, hosting, app elements or advisory services. Staged open release, which is one of the proposals for MasterMap, is another method that supports start-up and SME innovation but could limit innovation in the "M" of the SME if commercial pricing is not carefully balanced.

With rapid evolution in Smart Cities, connected & autonomous vehicles (and so on); new realms of data could be opened up for public bodies to make commercial gain from over and above the base layer (i.e. the National Information Infrastructure). For example, local authorities could charge vehicles for access to smart city sensors to provide optimised routing, parking or other value add services. The vehicle owner (private), lease company or manufacturer could pay an annual or pay as you go subscription for this enhanced data.

We would discourage further privatisation of our National Information Infrastructure. The sale of PAF to the private sector was clearly called out by the PASC and others as a mistake and plans to privatise HMLR were rightly shelved.

Ordnance Survey have been exploring a number of new revenue streams such as international expansion – we would like to see other areas of British expertise exported in the same way to help other nations create their own digital and data infrastructure. Partnerships with private sector experts would further boost this kind of model. This kind of knowledge and services export will help offset any revenue loss from making data Open.

We would also encourage agencies to find more ways to interact with users to ascertain the ultimate value of data to the economy and society. As recognised in the Commission's own paper, organisations such as CityMapper thrive on data released by the likes of TFL. If more case studies can be built to show the value of

an open geospatial dataset, stronger business cases can be made to maintain and invest in the underlying data.

We urge caution with any changes to charging or licensing regimes. The ecosystem around existing datasets is complex and could be slow to change. Regular interaction with user groups and industry bodies will be needed before any fundamental change to pricing or licensing. Any changes should be applied consistently across the sector, regardless of organisational size.

Too much geospatial data is still collected in an ad hoc manner by regional public bodies or by individual local authorities. This leads to the creation of useful data sets, but they are data sets that can't be applied nationally, or even regionally in many cases and which often aren't updated because of their ad hoc nature. Whilst there may be similar data collected by other local entities, there can be little consistency in data quality or definition. Greater and more formal interaction across public bodies to determine which ad hoc data sets have proved useful would at least focus attention on wider initiatives to collect this data more universally, to defined standards and relevant updating.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We have no comment on this question.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector can play a significant part in helping to collect, manage, store and enhance geospatial data.

However, this must be done in a way which does not prevent open release or give unfair advantage to certain businesses or sectors.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The most significant challenge around accessing geospatial data is licensing. With a mixture of Open and commercial licenses with multiple suppliers and various requirements to fulfil around derived data and other licensing pre-requisites (such as needing a PAF or OS license to use address data) it is often difficult to combine a variety of data and create viable products for end users. The complexity of licensing adds to cost without even factoring in data royalties. The royalties themselves are complex, don't always work well when combined and don't always allow for data use in the way that end users want (such as a click cost being permanent rather than renewable as in the OS AddressBase license). As an example of the licensing issue, there are over 100 housing associations who would benefit from AddressBase Premium per click licensing but cannot afford the renewable click licensing available from the OS today (nor can they afford to pay more than a penny or two for a single record). Aligning OS addressing licensing directly to the PAF license would simplify the market and mean more users of OS data.

Finding data, metadata, support and documentation is also challenging. Whilst the OS have dedicated teams and materials to help developers and re-sellers, the pattern is patchy with other public entities who may be selling data or making it available openly. Clear support structures and SLAs are needed if value added resellers are to provide quality products to enterprise.

Standards in licensing, pricing and format would help. Ensuring that key identifiers such as UPRN, UDPRN, TOID, grid reference and so on are available in all datasets and are open & free to re-use would certainly help bring data together. The use of common formats such as CSV would also benefit users who are less able to purchase the expensive GIS platforms needed to access mapping data.

Clearly, considering the benefits of SaaS and DaaS platforms should also be a priority but bulk downloads of databases should always be an option for users.

Finally, we would again repeat our concerns that too much geospatial data is still collected in an ad hoc manner by regional public bodies or individual local authorities which whilst creating useful data sets, cannot be applied nationally or regionally and are not consistent

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We would encourage the Commission to support the public sector in using and re-using data and helping their service providers better integrate the data into common software tools such as CRM packages or their websites. Standards will play a key role and we would also encourage public bodies to invest in releasing their data to those standards (such as the ones created by the LGA for spending data). By creating and using data standards, quality improves and usage increases throughout the ecosystem.

The PSMA and OSMA were huge steps forward and we would encourage the continuation and widening of these schemes. We would also encourage the commission to examine similar arrangements for certain sectors such as Charities, Utilities, Housing Associations and others (as an example, this could help smaller market entrants in utilities compete more effectively if they had the same mapping and address data as the Big 6). This would also encourage standards and improved data quality across industries where data sharing is critical to the consumer outcome (such as MiData & switching in utilities, or Open Banking in financial services).

The Commission can also be supported more widely in achieving this goal by engagement with other groups which are interested in the use of geospatial data by the public sector such as MRS CCG.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We have no specific suggestions at this time but would encourage the commission to learn from the Open Data User Group and bring back their data request mechanism to better engage data users to ensure more data is released in a strategic way with clear benefits cases. Since that group ceased, there is little evidence of a coherent process for releasing new open data and whilst the likes of Companies House and the Environment Agency have made excellent progress, too often there is a reliance on FOI processes for getting data released in a piecemeal and often local way with little though to onward re-use.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

We have no comment on this question.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Working with the LGA and similar bodies, the use of standards needs to be promoted with enhanced funding for those who do use them and perhaps publicly available data quality measures to show how good data leads to better services.

We will again cite spending data as an example of where standards are readily available on the LGA website but are often not followed – this makes the use of spending data by organisations looking to help public sector difficult as a lot of effort in cleansing and matching the data from different public bodies needs to take place before it can be of use. Many commercial software tools (such as ETL tools) are available to help take data from internal systems, cleanse and format it and then publish it to open data hubs – the Commission could work with vendors to create licensing models that support the Public Sector in a similar vein to the PSMA.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**

- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Experian already have several geospatial applications in these categories which deliver economic value, and can deliver more with the right data developments.

The most widely known is the Goad solution which has been at the forefront of property information since the plans were first created in the 1890s. Development has been hampered by challenges accessing and matching complementary datasets, including VOA data. Linking VOA, HMLR and EPC data to the existing solutions in the property, land and construction space will deliver extra value. That data linkage relies on better consistency in the data files. These solutions also use Mastermap for visualisation so any changes to the royalty structure and access rules would be an important consideration.

Experian also work extensively with our clients supporting their Sales and Marketing effort. This work is based on geospatial data (people, places, and locations) linked to Location Analytics tools. These can all be enhanced through the provision of better linked Open Data sources. In the marketing sense there are broader applications across multiple channels and the proliferation of digital out-of-home and mobile marketing in particular rely on the location context for which spatial data is vital.

Experian are a leading data and solutions organisation in helping clients use data to improve their sales and marketing effort. We would welcome the opportunity to discuss these solution types with the Commission if it would help in your evidence gathering process.

Q18: Are there any other areas that we should look at as a priority?

We have no specific comments here.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We have no specific comments here.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We have no specific comments here.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We would call out countries where all address and mapping data has been released openly.

A good example of open address registers is Denmark where significant innovation has been powered by increased use of reliable and free address data.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Farset Labs
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

While the provided definitions are refreshingly clear and encompassing, I believe there is a missing piece in terms of geospatial relation; particularly in an urban context. Navigable routes with associated access metadata are vitally important to analysing concepts such as catchment areas, impact assessment, and service / investment planning.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Openness, Transparency and Accessibility to geospatial data is essential in removing barriers to entry for leveraging the insights that that data can provide to upstream/derived analysis and planning.

This needs to be a regionally coordinated and unified approach; piecemeal approaches adopted in the past have led to differential service delivery across regions and has made inter-region trade in expertise and service provision challenging.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Access to Data is paramount. In Northern Ireland, Land and Property Service (LPS) hold a tight grip not only on access to data, but using obstructive licensing terms, strangle the service delivery/commercialisation of any 'experimental' innovations that can be generated. This also blocks the ability to meaningfully educate people in the access/use of this data because of this upstream blockage. For instance; say a hackathon was run focused on geospatial data, but we as organisers had to point out that "If you use this data-source and you want to charge for the insights your generated IP can provide, you will have to enter into negotiations with a government office before you can even attempt to test product/market fit".

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Access Postcode Geolocation data in Northern Ireland is literally a joke within the data science / geo spatial community. There is currently no legal, accurate, way map either from a geospatial point to a postcode, or vice versa.

See also response to Q3

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Adoption of open, linked, data standards (See 5* Data Classification model) is paramount in enabling innovative applications of derived geospatial data to contextualise and easily related analyses across other available datasets. https://www.odcamp.uk/open-data-case-study-how-belfast-found-350000-in-rates-revenues-using-open-fhrs-data/

Innovation, and hence IP and socio-economic impact, should reside in what you can do with the data, not the data itself.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

5* Linked Data Stores where centrally managed data can be queried for relevant subsets of data, rather than massive datasets that must be locally downloaded and filtered for processing.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

See previous answers related to data management and openness

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

See previous answers related to data management and openness

Additionally, adherence to open standards in procurement pipelines will lead to sustainable maintenance of assets without ‘vendor lock-in’, encouraging growth in specialised geospatial data processing SMEs

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

See Q9

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to

improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

See Q9

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

See Q9

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Land ownership / Usage

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Setting open, cross-compatible standards for core datasets across regions, and their licensing terms.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Providing both a ‘showcase’ capability; allowing LA’s and partners to ‘show off’ their work (and methods) as well as coordinating and cultivating open source ‘toolkits’ for the management and meaningful analysis of data.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Social welfare and equality

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Particularly in the context of Northern Ireland (but not only); regulatory and standards inter-operability (and ideally cooperation) with the EU, and particularly the Republic of Ireland will be extremely important; ecosystems, weather, and water system don't adhere to administrative borders, and leveraging datasets/sources from other nations will be essential in facing and understanding these challenging areas

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Cultivating and sharing expertise; be generous with our outputs and findings on a global scale, as well as providing standards such that other regions can emulate and build on our advances.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Taiwan https://opengovreport.ocf.tw/en/report/#tab-0

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Flood Re
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I'm not completely sure what your view of geospatial data types is, but the three key themes identified above certainly appear to cover the breadth of geospatial data potential. Certainly the insurance sector has the potential to rapidly uptake and increase the amount of spatial data that is used, and particularly to make use of the joining of disparate spatial data sets in order to create new insights. Much flood data (e.g. locally surveyed channel cross sections) is already held at a very local Council level, and assimilating a national collection of such data would be very beneficial. Other (non-locally acquired) data such as from remote sensing (e.g. building footprints, tree locations) has potential to bring benefits to the insurance industry but the geoprocessing of much of this data to make it meaningful to property level information (e.g. that can be stored in .csv files or relational databases) is not trivial at all and such products are very expensive to purchase.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission should focus on skills regarding the accurate surveying and processing of remote sensing and ground based observations to ensure that data is as accurate as possible. The projection system that is used is often confusing, particularly when working on remote regions. Bringing together separate datasets with different projections has in my experience been much better to undertake using R or Python or SQL that via a dedicated GIS software system such as ESRI or QGIS. This is one of the main reasons that I tend to re-project all spatial data within R or Python or SQL because it is more repeatable, does not do "projection on the fly" which can get confusing, and is less of a "point and click" approach so there is a more easily accessible audit trail of work done. Focusing on these skills would help to move GIS data away from being purely "visual" to becoming a source of data to be analysed more easily.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

GIS software products such as ESRI and programming skills in languages such as Python are often lacking; these skills may be best promoted through the explicit inclusion in a "Data Science" skill set, whereby the processing of this data is undertaken to produce a more simple data set (e.g. relational tables) that can be quickly analysed repeatedly.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The elevation of properties in the UK would be useful as a flood risk metric, but the geoprocessing of this using LiDAR data for 28million UK properties is computationally unfeasible. Cloud technology exisits to make this feasible, and Python code could be written to do this. However, the downloading and pre-processing of the data from the Environment Agency would also take additional time. Nevertheless, the addition of the results as a field to our UK property database would be very useful. This would be of value as a check on flood footprints and the probability of a property being flooded (and claims being true) if elevation were included.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Much spatial data is made of of multiple “tiles”, which can only be easily downloaded using a computer script to download as a batch. Ensuring that web addresses and passwords are configured so that this is possible is very useful and saves a lot of time. API technology for example can make a lot of this much easier. The value of this is in the saving of time and removal of “human error” during download.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

The UK capability in Earth observation data should be developed to improve the timeseries data and classification of land use so that changes can more easily be accessed and evaluated. Obtaining such data is currently quite challenging and because the data sets are often large then it is not straightforward to evaluate agriculture change for example. The cost of such products is often prohibitively high as a result.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

GPS systems within phones for example have the potential to massively increase the monitoring of flood events via citizen science approaches. Obtaining such data from places like Twitter is possible to do in real time and can act as a good calibration to modelled flood event footprint data. The cost and robustness of data loggers for this is generally high and equipment has generally been targeted towards high precision technology. The citizen science and background data is largely untapped but could rapidly improve information availability during flood events.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data can be used in the pre-roll-out stage to analyse where future technologies may be successful; e.g. to identify locations of poor air quality where new measures could be implemented (based on past observations). Additionally, new technologies such as water leak detection could be improved if the geospatial element of leaks was better understood in conjunction with sewer maps to better predict flood flows from sewers.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector organisations could make sure that details of properties are recorded along with the UPRN to make joining the locally collected data to other property databases more easy. Drone and ground based data that is obtained during routine surveying should be routinely digitised and given a timestamp and reference number to be stored in a corresponding database. This would make it easier to merge data from different sources to fill gaps. For flood events in particular this would in time result in a better and more complete picture of flood footprint extents.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Prioritise the development of databases so that data can be more easily accessed and synthesised. With regards to the actual collection of data, the assimilation of data from multiple GPS systems would give an improved best estimate and uncertainty envelope.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should be involved in order to make sure that the data that is collected is stored and processed in such a format as to be usable by a wider audience. Currently much of the data is not considered well in the private sector, which makes the cost relatively high.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The main challenges are around the size of geospatial data (e.g. LiDAR data) and the computational challenges of processing such data. If geospatial data were made available in the public sector in both its raw format and also in some geoprocessed format (e.g. elevation by property) then the data would not need to be separately geoprocessed each time. Model vendors in insurance frequently provide their data in both map form (e.g. flood risk maps) and in .csv form where tables of flood depth are provided against a UPRN for each property. This post-processed version is invaluable in terms of data analysis, and means the data can be easily used, rather than just "visualised".

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Become a hub for data download and have a website that offers guidance/technical support. Making sure that data is available in a digestible format in a “one stop shop” would make it much easier to understand what data is actually available.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Locally surveyed river cross section data – this would support flood modelling; claims data from insurance companies would make it much easier to understand the impacts of flooding. This is currently private data held by insurance companies. Although privacy issues are clearly paramount, some sharing of this data would really help to build up a clearer picture of flood impacts around the country.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Have a dedicated geospatial data body that can act as a data source for regional data – hydrometric data measurement (although not geospatial in its own right) is very under funded and a low priority in the Environment Agency. In a similar fashion, giving a hub and focus to the data centre would help to improve its visibility. Databases may be different for different regions but a single focus would help to improve overall leverage of the data sector.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Digitising local data and agreeing a standard form would help to make sure that there is more easy sharing of data. Meta data is also extremely important in this regard.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Develop the links between property and land, infrastructure and construction and natural resources. Flood Re have no insight to the development of infrastructure and property (particularly in the flood plain) but in future may be expected to have an opinion on this. The data to support our understanding is not currently accessible – we are collating data at the property level (particularly residential) that includes flood risk but this is in a relational form (tables). Currently our buildings are “points” and new technology is moving towards building footprints. I’m not sure how we would easily rationalise this data but it could at first simply be “proportion of building footprint in floodplain”. Developing this for all properties in the UK would give us greater oversight for new properties and their potential flood risk (which we are not currently obliged to cover but may have an interest in in the future).

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Regulatory challenges around GDPR and data privacy/security

Q20: How best can we make the UK's presence in the international geospatial world more visible?

National centre/research initiatives.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Remote regions such as parts of South America and India present very different flood risk challenges compared with the relatively densely monitored UK. The need in such regions to rely on remote sensing data is a key learning area. Agriculture and land use change in India for example support a large proportion of the economy and such a region is a learning area for the UK as the challenges are so different.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Forestry Commission Scotland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There is some confusion as to what the four data descriptions actually mean and what their purpose is. We feel it is important to use plain English from the start – particularly if we are going to achieve 'buy-in' from the wider geo-spatial community and non GI specialists.

We feel that 'geospatial' is wider than just data and the strategy must reflect that.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Education:
At this time, 'geospatial' is still seen as being a highly specialised area – even amongst IT professionals who often leave University with little or no knowledge or understanding of it's relevance in today's workplace. It is essential that geospatial skills are embedded within the education system right from the start of the process, continuing all the way through to University. The commission should work with AGI and others to ensure that geospatial is fully integrated within the curriculum and that GI becomes an integral part of IT professionals toolkit.

Awareness:
It is important that government staff at all levels and particularly senior staff, have an appreciation and awareness of how geospatial can help aid decision making, improve efficiencies and deliver results. The 'power of place' and the 'science of where' can only be delivered geospatially.

Technical Skills:
Geospatial skills require practitioners to blend science and geography:

1. Efficient Management of spatial data and non-spatial data
2. Cloud computing
3. Creating and managing web services
4. Creating and managing metadata
5. Coding, scripting and API development
6. Understanding machine learning and artificial intelligence
7. Understanding of Earth Observation and Analysis Ready Data (ARD)
8. Cartographic techniques
9. Data analysis skills
10. Presentation skills
11. Project management and business analysis skills

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The skill needs are listed in Q2.

In terms of careers, in order to attract the best people there needs to be much better recognition of geospatial skills and GIS as a profession within the public sector.

It is important that the geospatial profession is recognised and given the same status and renumeration as other equivalent professions (scientists, statisticians, accountants, auditors, etc) – GeoComm should consider the DDAT framework.

It is becoming increasingly difficult to attract top applicants to GIS jobs in the public sector. This is almost entirely down to the fact that we cannot offer comparible pay to the private sector.

Within the wider Forestry Commission, we have benefited from a significant number of overseas GIS specialists working within the organisation over the past 5-10 year (eg. from Portugal, Greece, Italy, Poland, Holland and further afield such as Ghana and Asia). This situation may change following BREXIT and it is unclear at the moment whether we can attract those skills within the UK at a price we can afford.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

GeoComm role should prioritise data used by multiple organisations to see if there are other datasets which should be subject to national procurements as per OS and AP. FC aspirations would include;

- Open public access to RPIDs LPIS boundaries and RoS land ownership boundaries would be extremely useful across a wide range of business areas (plant & tree health, grants and regulations, Scotlands Environment, land searches, housing development, etc, etc).

- Utility data of great importance to FC particularly that with H&S implications (electricity, gas). It would be great to have a single source of truth for utility data.

- Snapshots of up-to-date, analysis ready Sentinel 1 & 2 data - both for time series analysis and real-time data. Aim should be that RS datasets which require a lot of pre-processing be delivered as analysis ready data (ARD)

- High resolution (i.e. sub-metre) satellite imagery
- LIDAR (national cover for Scotland & regularly updated – possibly 5 yearly)
- Well structured and up-to-date Planning application data from Local Authorities – preferably confirming where those applications have successfully gone ahead.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- FC is not a heavy user of addressing but supports a more collaborative approach to addressing.
- GeoComm should be open to new location initiatives e.g. What3Words

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

EO is significant emergent technology (particularly due to Copernicus initiative) . The FC has made regular use of satellite data, particularly in delivery of the National Forest Inventory and has aspirations to make much more use of satellite data going forward, somewhat predicated on easy access to readily usable analysis ready data (ARD).

- GeoComm should make every effort to support increasing usage of EO data and derived ARD products;
- GeoComm should support existing initiatives such as DEFRA EODIP which is beginning to pay dividends (EO Alpha….)
- GeoComm should support creation and supply of Analysis Ready Data for those who do not have infrastructure and skills to generate their own. The traditional OS model might apply here. We can't all be national mapping agencies so depend on one organisation to provide us with the map products we need, the same model could apply to EO sector with a one organisation doing the necessary data management and pre-processing to provide the products the market increasingly aspires to. This could be private, public, or collaboration.
- EO skills
- GeoComm needs to look at what other RS products would be of wider benefit;
    - Higher resolution imagery?
    - LIDAR?
- GeoComm needs to make sure there is no discontinuity of supply as a consequence of BREXIT

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Real-time data (e.g. mobile gathering, crowd-sourced data, Internet of Things).
- Linked data
- Modelling and analysis of future scenarios for decision making.
- Location based services.
- APIs for the public, developers and private companies to create their own applications based upon public sector data.
- AI and machine learning
- LiDAR (not being used effectively)
- Unmanned aerial vehicles
- Hyper spectral imagery / SAR
- Internet of Things
- Data Cubes
- Greater coverage of mobile signal in rural areas – and wider coverage of 3/4/5G – enabling wider usage of mobile phone apps – in many cases enabling smarter delivery of government

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Unmanned vehicles
- Mobile technologies
- Virtual reality and immersive environments
- Recreational apps/games
- Observation: by their nature and scale most technological advancement comes from Multinational organisations

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- The public sector in Scotland is quite successful at capturing geospatial data assets in order to meet business needs. More consideration could possibly be given to how this data is subsequently delivered to the wider community (public and business).
- For new datasets, fundamentally, if there is a business requirement, or if it's useful, people will invest
- Funding of specialist government departments, with key expertise, to carry out specific tasks / data gathering is a good well-established model.
- Organisations working together to increase efficiencies (eg. SEWeb)
- Local government is tasked with collecting data for a number of national datasets at a local level. This fragmented approach has made it almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this. However more work on standardising data collation for common datasets across LA's would be beneficial (eg. TPO's, Greenbelt, Core Paths, etc.)
- How data is presented, made available to the public - needs to be driven by user needs

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS now absolutely vital element of many apps – especially those with geo-content. Security of service and a strategic direction of travel for UK is essential for UK (impact of BREXIT a consideration).

If possible, we should ensure that there is no degradation of GPS accuracy as a result of BREXIT.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector should provide;

- Anaysis Ready Data (ARD)
- Ability to store and use 'big data' including data security and distributed storage of data.
- Increasingly access to archive data
- Innovation, in particual innovation based on public sector generated data for economic growth, citizen science and location based services etc. which in turn will increase use of and investment in Geospatial data.
- Private sectore should provide (publicly procured?) national datasets such as; satellite, LiDAR, aerial photography, including continuity of update and supply. Data usability a key factor.
- Provision of technologies required to collect, store and analyse spatial data
- Partnerships between private and public sector e.g. existing procurements
- Publications of web services and data to both government and its contractors - perhaps temporary access or limited geographically

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

GeoComm could deliver;

- Clear guidance and standards for the collection, storage, maintenance, presentation of data and metadata, particularly for national level datasets. INSPIRE has been a good model but it is old and fast becoming outdated. However we do not want to end up with dual standards. Therefore a review and extension of INSPIRE would be preferable.
- As per Q9. Local government is tasked with collecting data for a number of national dataset at a local level. This fragmented approach has made it

almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this.

- OGC compliance
- Occassional licencing issues – particularly in instances where the data has been derived from a third parties dataset (eg. some of SEPA's datasets have CEH IPR)
- Should there be a central data repository or spatial data hub? On balance probably not required if robust data discovery is in place e.g. INSPIRE, data.gov.uk (DGUK) are working well. DGUK (or equivalent) needs to be much smarter (e.g. improved filtering) if it has to deal with more data.
- More widely available mobile signals and 3/4/5G for remote working and improved offline services

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Co-ordinated procurement that focuses on ease of use downstream
- Look beyond PSMA and APGB …..LiDAR, satellite…
- Act as intelligent customer, but GeoComm must ask what public sector needs, it mustn't assume and must give customer a voice e.g. PURG, GICG or similar
- Listen to devolved government needs, sometimes the challenges are very different.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Geospatial Commission to procure regularly updated LIDAR data for GB
- Analysis ready Sentinel Data – imagery and radar
- Sub Metre Satellite Imagery
- Rural Land Register boundaries
- Land Registry Registered boundaries (and those of Registers of Scotland too)

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- UK strategy should complement not conflict with, other national and organisational strategies (devolved administrations most obviously).
- Needs to address inconsistencies of content (e.g. MasterMap scale inconsistency across UK, mobile cover across UK)
- Needs to address inconsistencies re release of data – on one hand public sector is asked to provide Open data, on the other to generate income,. You can't generate income from data if you've given it away free already. Cost/benefit of Openess needs to be better understood.
- Need to consider rural/environmental needs as much as urban

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Standardisation (or at least a template of mandatory fields) of datasets that are common across all Local Authorities (TPO's, Green Belt, Town Centres, etc).
- More relevant perhaps is access pan Local Govt data where inconsistency reigns. Again, as per Q9. Local government is tasked with collecting data for a number of national dataset at a local level. This fragmented approach has made it almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Natural Capital Accounting
- Environmental access and mobility, facilities and assets for commercial and casual recreational use
- Forestry Commssion Scotland can provide info on woodland creation for many uses (eg. carbon accounting, natural capital accounting, ecosystems and biodiversity, agriculture, timber processing, habitat mapping etc)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

EO Alpha and access to Sentinel data

Driverless vehicules

Open Data

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Focus on technology rather than data provision – UK data usually covers UK – UK technology can cover the globe.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

USA – USGS - https://www.usgs.gov/products/data-and-tools/gis-data

Norway – Kartverket - https://www.kartverket.no/en/data/Open-and-Free-geospatial-data-from-Norway/

Denmark – Danish Geodata Agency - https://eng.gst.dk/

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Forestry Commission (inc. Forest Research)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
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Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It's not quite clear why we are being asked about these four 'data types' in particular. We believe these definitions are confusing, particularly if the anticipated audience is non-specialist, and that other better definitions exist already. Overall the Call for Evidence is 'datacentric' – perhaps not focussing sufficiently on what (emerging) technologies might offer.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

It's essential that we increase 'geo-awareness' more widely and, within government, at all levels:

- Increase awareness of Geospatial and what it can do to release potential
- Some geospatial content should become part of the core school curriculum
- And it should be a key element of Geography education at tertiary level (i.e. it should not be possible to complete a geographically related degree without some experience of geographic software and data)
- It should be recognised that geography is a skill/profession.

Technical skills

- Programming languages for data processing, scripting and software development
- Open Source software/technologies
- Spatial data management techniques to ensure high quality data used for decision making and visualisations.
- Database skills

Remote sensing skills

Traditional skills should not be lost sight of:

- good cartography
- accurate digitizing
- clear information/spatial-data presentation

Emergent technologies

- Cloud computing
- Artificial Intelligence
- Machine learning
- Big data
- Utilising modern web technologies for sharing and visualising of data.

Other

- Coordination and sharing of data: maximum benefit for minimal effort
- Soft skills such as project management, presenting and communication
- Innovation relating to how to use spatial data for products, services and information to generate economic opportunities.
- Increase commercial expertise required within government

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

See response to Q2 in terms of 'skills needs' - focussing here on careers;

Pay is an issue, the skills are out there but increasingly too costly for public sector i.e. recruitments increasingly producing fewer good applicants

In terms of career promotion, we need more people from UK with geo-skills. Changes to political landscape has made recruitment harder, particularly of temp staff;

- previously we received many CVs from foreign (predominantly Asian) applicants who were able to stay in UK for 2 years post-graduation – legislation change closed this avenue.
- previously we received many CVs from European applicants who were able to work in UK via EU Regs – indications are that there are fewer Euro applicants and it seems likely that BREXIT will close off this avenue too.

'Geospatial' needs to be recognised/remunerated in the same way as other professions in the public sector (e.g. Stats, Economics, Legal)

GIS needs to be seen as corporate, not niche. Centralised GIS solutions should prevent departmental siloes. We need to move away from reliance on shapefiles/Geodatabases towards corporate spatial data storage and analysis.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

GeoComm role should prioritise data used by multiple organisations to see if there are other datasets which should be subject to national procurements as per OS and AP. FC aspirations would include;

- Utility data of great importance to FC particularly that with H&S implications (electricity, gas). It would be great to have a single source of truth for utility data.

- Snapshots of up-to-date, analysis ready Sentinel-2 data - both for time series analysis and real-time data. Aim should be that RS datasets which require a lot of pre-processing be delivered as analysis ready data (ARD)

- High resolution (i.e. sub-metre) satellite imagery

- LIDAR (national cover, regularly updated)

- Resupply of some existing datasets which will be improved if based on better quality source data (e.g. the LIDAR and sub-metre data referred to above)

- Rural Land Register (RLR) polygon data to help land owners better plan and manage their estate using GIS
- Land Registry leasehold polygon data (freehold data is already available)

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- FC is not a heavy user of addressing but supports a more collaborative approach to addressing.
- GeoComm should be open to new location initiatives e.g. What3Words

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

EO is a significant emergent technology (particularly due to Copernicus initiative). The FC has made regular use of satellite data, particularly in delivery of the National Forest Inventory and has aspirations to make much more use of satellite data going forward. These aspirations are somewhat predicated on easy access to readily usable analysis ready data (ARD).

- GeoComm should make every effort to support increasing usage of EO data and derived ARD products;
- GeoComm should support existing initiatives such as DEFRA EODIP which is beginning to pay dividends (EO Alpha….)
- GeoComm should support creation and supply of Analysis Ready Data for those who do not have infrastructure and skills to generate their own. The traditional OS model might apply here. We can't all be national mapping

agencies so depend on one organisation to provide us with the map products we need, the same model could apply to EO sector with a one organisation doing the necessary data management and pre-processing to provide the products the market increasingly aspires to. This could be private, public, or collaboration.

- EO skills

- GeoComm needs to look at what other RS products would be of wider benefit;
    - Higher resolution imagery?
    - LIDAR?

- GeoComm needs to make sure there is no discontinuity of supply as a consequence of BREXIT

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Real-time data (e.g. mobile gathering, crowd-sourced data, Internet of Things).

- Linked data

- Modelling and analysis of future scenarios for decision making.

- Location based services.

- APIs for the public, developers and private companies to create their own applications based upon public sector data.

- AI and machine learning

- LiDAR (not being used effectively)

- Unmanned aerial vehicles

- Hyperspectral imagery / SAR

- Internet of Things

- Data Cubes

- Greater coverage of mobile signal in rural areas – and wider coverage of 3/4/5G – enabling wider usage of mobile phone apps – in many cases enabling smarter delivery of government

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Unmanned vehicles
- Mobile technologies
- Virtual reality and immersive environments
- Recreational apps/games
- Note: GeoComm may wish to refer to DEFRA's 'Emerging Technologies Radar - Release 2 - Q2 2018' produced by DEFRA DDTS
- Observation: by their nature and scale most technological advancement comes from Multinational organisations

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- The raison d'etre for much public sector data is well established with clear linkage to business objectives. By and large the right organisations collect the right data.
- For new datasets, fundamentally, if there is a business requirement, or if it's useful, people will invest
- Funding of specialist government departments, with key expertise, to carry out specific tasks / data gathering is a good well-established model. For example DEFRA's EODIP programme could be seen to be a model for dealing with new/sizable/complex challenges.

- Coordination of separate organisations to increase efficiencies
- Local government is tasked with collecting data for a number of national datasets at a local level. This fragmented approach has made it almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this but it's a much bigger challenge in England. in this case we would recommend that GeoComm provides enabling Web tools which drive all LA's to capture to same standard; the 'build it and they will come' approach.
- How data is presented, made available to the public - needs to be driven by user needs
- Making data rather than information available to users

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS now absolutely vital element of many apps – especially those with geo-content. Security of service and a strategic direction of travel for UK is essential for UK (impact of BREXIT a consideration).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector should provide;

- Ability to store and use 'big data' including data security and distributed storage of data.
- Increased access to archive data
- Innovation, in particular innovation based on public sector generated data for economic growth, citizen science and location based services etc. which in turn will increase use of and investment in Geospatial data.
- Private sector should provide (publicly procured?) national datasets such as; satellite, LiDAR, aerial photography, including continuity of update and supply. Data usability a key factor.
- Provision of technologies required to collect, store and analyse spatial data
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GeoComm could deliver;

- Clear guidance and standards for the collection, storage, maintenance, presentation of data and metadata, particularly for national level datasets. INSPIRE has been a good model but is under used – it should be promoted rather that reinvent the wheel
- As per Q9. Local government is tasked with collecting data for a number of national dataset at a local level. This fragmented approach has made it almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this but it's a much bigger challenge in England. In this case we would recommend that GeoComm provides **enabling Web tools** which drive all LA's to capture to same standard; the 'build it and they will come' approach.
- OGC compliance

- Should there be a central data repository or spatial data hub? On balance probably not required if robust data discovery is in place e.g. INSPIRE, data.gov.uk (DGUK) are working well. DGUK (or equivalent) needs to be much smarter (e.g. improved filtering) if it has to deal with more data.

- More widely available mobile signals and 3/4/5G for remote working and improved offline services

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Co-ordinated procurement that focuses on ease of use downstream

- Look beyond PSMA and APGB …..LiDAR, satellite…

- Act as intelligent customer, but GeoComm must ask what public sector needs, it mustn't assume and must give customer a voice e.g. PURG, GICG or similar

- Listen to devolved government needs, sometimes the challenges are very different.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Geospatial Commission to procure regularly updated LIDAR data for GB

- Analysis ready Sentinel Data – multispectral (Sentinel-2) and radar (Sentinel-1)

- Sub-metre (i.e. high resolution) Satellite Imagery

- Rural Land Register boundaries

- Land Registry Registered boundaries (and those of Registers of Scotland too)

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- UK strategy should complement not conflict with, other national and organisational strategies (devolved administrations most obviously).
- Needs to address inconsistencies of content (e.g. MasterMap scale inconsistency across UK, mobile cover across UK)
- Needs to address inconsistencies re-release of data – on one hand public sector is asked to provide Open data, on the other to generate income. You can't generate income from data if you've given it away free already. Cost/benefit of Openness needs to be better understood.
- Need to consider rural/environmental needs as much as urban

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Perhaps not best placed to comment on how Local Government use geospatial to deliver its business but there must be exemplars across the country that could be learned from and applied more widely (e.g. apps in Edinburgh supporting public transport). Start point – what do we need Local Govt to do for us, then, who does it best??
- More relevant perhaps is access pan Local Govt data where inconsistency reigns. Again, as per Q9. Local government is tasked with collecting data for a number of national dataset at a local level. This fragmented approach has made it almost impossible to collate this data nationally. Improvement Service in Scotland has taken positive steps to resolve this but it's a much bigger challenge in England. In this case we would recommend that GeoComm provides **enabling Web tools** which drive all LA's to capture to same standard; the 'build it and they will come' approach.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Natural Capital Accounting
- Environmental access and mobility, facilities and assets for commercial and casual recreational use
- Forest Research can provide info on woodland and woodland change for many uses e.g. carbon accounting, natural capital accounting, ecosystems and biodiversity, agriculture, timber processing, habitat mapping etc

Q18: Are there any other areas that we should look at as a priority?

Nil return – see other responses.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

EO Alpha and access to Sentinel data

ID of ‘Best of Government’ and rolling out across other government departments …and more widely

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

Focus on technology rather than data provision – UK data usually covers UK – UK technology can cover the globe.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Landsat Data Cube - GeoScience Australia - image archive - the technology has been made openly available

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Frazer-Nash Consultancy
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**x**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We feel that the types should be extended to include:

Metadata: UK will require appropriate metadata (including schemas and services) to support discovery, distribution and (secure) sharing of the types of geospatial data listed. Metadata services are valuable information resource, which can help provide valuable insight into how data is being used, and where gaps exist.

Also, none of these data definitions would adequately cover **supporting geospatial data resources**, such as geospatial **taxonomies** and **ontologies** (such as Ordnance Survey Linked Data, or OGC GeoRDF topology definitions.

Finally, the inclusion of (4) '**Geospatial Services**' on a list of data types is a bit confusing, as data and services are really distinct things. (Perhaps the list here is really describing *information classes* rather than *data types*?) The definition provided ('layers of various types of spatial information') really seems to be describing 'Data Products' – which could really be provided in a number of ways, e.g. as a serialised data resource (such as a file or image), or as a service (such as a WMS).

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Skills

We believe there would be considerable value in placing a focus on development of geospatial skills in the UK.

- Understanding the profile of skills demand across various sectors, now and in the future
- Developing a geospatial skills framework and learning pathways for those looking to acquire geospatial skills
- Looking at skills overlaps between different sectors, for example, computer science, data science, programming, geospatial.
- Through engagement with AGI and RGS, could the commission help to define chartership and continuous professional development standards, and requirements, specifically to meet the requirements for UK-related geospatial skills development?

The fact that geospatial software engineering has considerable appeal from a careers perspective, offering a unique combination of characteristic – combining qualitative, scientific principles with qualitative, artistic and creative ones. The commission might have a role in communicating or promoting the diversity that can be found in a geospatial careers, including imagery & remote sensing, spatial analysis, machine learning and machine vision, cartography, GUI design and HMI, client application development, data modelling, software/solution architecture, spatial data infrastructures, geodesy, and so on.

This could be aligned with wider government initiatives to understand and improve the representation of women in STEM careers.

Data protection

The commission could help to develop a unified position around the understanding of data protection (e.g. GDPR) issues specifically relating to storage and sharing location data. For example, it is widely appreciated that capture and storage of geospatial attributes increases the risk that personal information can be inferred through spatial analysis and other regression techniques? However, these issues (and potential mitigations) are not well understood, and uncertainly around these risks might become a barrier to sharing and exploitation of geodata, and development of the geospatial data market, in the UK

I wonder if this question needs to be turned inside-out; The fact that the GC is asking this question demonstrates that they – understandably – don't have a handle on skills requirements and their drivers.

Market analysis and trends

The commission's role might include an ongoing programme of research and analysis in this area, providing a rolling 2, 5 and 10 year view on geospatial trends in the UK. Various market reports are available that do this globally, or for specific sectors (e.g. defence GeoINT). Some things to monitor would be:

- Technologies – trends in use of FOSS, COTS software
- University courses – what skills are being taught. How applicable are they?

- Data – perceptions of how much geodata exists within an organization, and how much could be shared/exploited?

Maybe construct some questions to explore and extract understanding of perceptions and trends?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Geospatial developers are often (typically) required to get involved across all areas of the software engineering lifecycle and architecture; A geospatial solution often demands knowledge of software architecture, data modelling and lifecycle management, database management, web service architectures, open standards, client development, GUI/HMI skills, and so on.

In our experience, there is a shortage of:

- Geospatial systems engineers that understand the full systems development lifecycle, including good requirements elicitation though to end user training;
- Developers with geospatial knowledge; for example, an understanding of geodesy, coordinate reference systems; spatial data portrayal and presentation; standards for geospatial data and APIs (including OGC standards); spatial toolsets and applications.
- Engineers with understanding of privacy and security issues and technologies relating to geospatial data.

GC could also coordinate promotion of real job opportunities and real careers, perhaps through cooperation with RGS and AGI.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The commission would ideally play a role in:

- Standardisation of data quality metrics for public geospatial data
- Assessment of those metrics
- Global terrain data at a reasonable quality (better than SRTM), global bathymetric data at a reasonable quality (better than GEBCO)
- EO data to avoid commercial costs for start ups

Rural Payment / Agri Data
Access to data relating to Rural Payment schemes is vital for stimulation of Agri-data-based innovation (which is currently a focus of the Agriculture & Horticulture Development Board and the various UK AgriTech centres). This would ideally include the spatial definition of each farm/claimant's land holding; schemes undertaken (e.g. specific conservation and stewardship schemes, crop subsidies, etc), and the payment made**.** There is some resistance to making this data available on the grounds that it is financial data that can be resolved to an individual farm or claimant, but the compelling counter-argument is that the payments are made from the public purse, and should be transparent.)

Ordnance Survey Linked Data.
Linked Data and other semantic datasets will be vital to stimulation of the semantic web, AI/machine learning applications and other machine-to-machine services. Ordnance Survey appears to have stepped back from maintaining a publically accessible Linked Data Resource. We feel that the commission should play a role in encouraging UK bodies (including Met Office, VOA, Land Registry, Ordnance Survey) to develop and maintain official Linked Data / RDF resources.

Meteorological Data

The commission should encourage the Met Office to make more data and data services publically available, and to publish these through open (e.g. OGC standard) web services, rather than through proprietary data services and software tools. Similarly, VOA, LR other UK data should be more readily accessible through standard web APIs.

UAV data
Autonomous or unmanned aerial systems are playing an increasingly important role in the UK economy, and significant opportunities exist across a range of sectors, including agriculture, maritime, utilities and infrastructure and commerce. The commission could take a role in assisting the CAA and other authorities in ensuring that there is an official UK dataset describing can-fly and no-fly zones, and ensuring that these geospatial information resources are released against recognised data and web service standards.

Catalogue/Registry Services
Provision of a central searchable data catalogue would be hugely beneficial in

aiding search, discovery and selection of the best data for the job, and would be a key capability of a UK GEOSS. The commission could play a valuable role in developing a UK catalogue/registry combining government, public and privately shared datasets. A federated clearinghouse of UK geospatial data would be a valuable resources of value to UK users.

The current data.gov.uk and UK 'Register of Registers' resources are not sufficient to support a modern geospatial data economy. Ideally, a central service should provide consistent web APIs for searching, viewing, assessment and download of metadata, datasets and feature data, ideally based on a registry information model (such as ebRIM).

Considering the volume and variety of geospatial data that could support a UK geodata economy, a search tool should support semantic search, and therefore needs to be founded on robust data models, taxonomies, controlled vocabularies. The commission might also play a role in encouraging industry and standards-organisations to developing these information models, which would also be vital in stimulating and supporting AI, machine learning and M2M services.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

As discussed in the responses above, the commission could take a role in ensuring that address data is encoded and published in standard formats and structures suitable for use in machine-to-machine systems and services, and for integration into the wider semantic web and IoT. The W3C/OGC Spatial Things standard would be a suitable encoding format.

A Spatial Things encoding of UK address data, combined with publication of UK address data as Linked Data, could would support development of the M2M services needed to support applications such as autonomous drone delivery.

The Geospatial Commission could also perhaps play a role in establishing what the relationship should be between Royal Mail addresses, Ordnance Survey data and other location resources (including UK Valuation Office 'non-addressable' location data, hereditaments, etc).

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We feel that GC should play a role in establishing create:

A persistent, enduring platform/infrastructure for EO data and services.
A sovereign EO capability, including UK-owned and operated EO satellite clusters.

Ground segment capabilities should include:

- Improvement in the cataloguing of remotely sensed imagery, especially from aircraft and UAVs which tends to be collected for specific purposes despite wider potential benefits
- Provision of integrated search/discovery services, showing not just existing EO data resources, but also data that will become available in near future.
- Platform-based delivery – providing a government source for EO data like digital globe GDBX, akin to what ESA are currently building. EO data is significant part of cost for developing a geo business.

EO data requires curating as well as cataloguing, and GC could provide a role in developing better quality metrics (and metadata) for EO data and services in the UK, to support more rapid discovery and exploitation of data. Very high-quality quality metadata will be required for M2M services.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

GC should support development of geo-semantic data and services, to support growth AI, ML and M2M services. This should include development of the detailed taxonomies and ontologies required for development of semantically-enabled Linked Data/RDF resources for UK. This 'semantic glue' is needed to enable integration of GC Partner data (including OS data) with other UK geospatial data resources (e.g. Royal Mail address data, GeoNames linked data, open data such as OSM, and domain-specific business geodata.)

These resources could also provide an online framework into which business and individuals can assert spatial knowledge and relationships, contributing to a shared UK geospatial knowledge graph.

We also feel there may be an opportunity for GC to oversee development of a collection of web services for use both within and outside government e.g. UK address, geocoding, traffic, isochrones, and base mapping services – revisiting and updating the Maps on Tap concept.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

This could be achieved by providing a UK geospatial infrastructure (a national Spatial Data Infrastructure) that enables businesses and individuals to contribute geospatial intelligence and data, i.e. managing the crowdsourcing of UK geospatial intelligence.

A UK SDI should include geodata, EO and Linked Data services built against (OGC) open standard interface definitions. This would also require the GC to oversee definition and maintenance of UK geo taxonomies, vocabularies and ontologies to support data sharing, linking and semantic services (including AI and ML)

The establishment of a UK EO services platform (whether by developing a UK satellite and EO programme, or through partnership with commercial EO data suppliers) could also enable public sector bodies to collectively share the responsibility of maintaining and enhancing geospatial data assets for the UK.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The GC also should prioritise technology approaches to deal with problems with urban canyons and indoor/urban positioning.
Particular attention should be given to safety and security risks relating to existing and emerging positioning technologies (such as location spoofing) and identification of mitigations.

(In addition to positioning technologies, and as noted above, GC would ideally prioritise development of the information infrastructure required to support development of geo-semantic data services, supporting delivery of the next

generation of M2M and AI applications.)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Opportunities to design, develop and maintain the underpinning spatial data, EO and positioning infrastructure should be offered to the public sector, e.g. via competition. There should be a mixture of fully funded and match-funded opportunities, designed to exploit innovation and capabilities of SMEs as well as larger organisations. GC should have a role in stimulating innovation and competition.

The existing Catapults should be used as a platform to reach out to industry – ensuring that the GC and wider UK geo strategy informs their individual remits in a consistent fashion.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Existing challenges include:

- Lack of open content
- Difficulty in accessing data held by some UK bodies (e.g. Met Office)
- Poor catalogue/registry search and discovery services; data.gov.uk not really fit-for-purpose for geodata
- Lack of adherence to appropriate open standards
- Minimal awareness and uptake of useful standards when public geo data is published online (WMS, Spatial Things, Vector Tile Services, Linked Data/GeoRDF in particular)
- Poor availability of UK Linked Data resources
- Lack of common reference data models (e.g. agreed metadata schemas, taxonomies, controlled vocabularies, ontologies)

- Lack of platform-based business services – For example, we would like to see OS offer data and compute services, where customers can bring their algorithms to the data, which would overcome complexities of storage, transport, licensing and off-boarding (deletion), and could enable serverless application development.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The GC could:

- Broker deals with commercial EO suppliers (such as Digital Globe) – perhaps to establish UK EO platform
- Campaign to open-up more UK data, e.g. UK agriculture payment data and Met Office data and services.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The GC should ensure that geospatial data (and related services) developed by academia are both easily discoverable and freely usable by UK businesses and citizens.

As noted above:

- UK agricultural land use and (potentially) subsidy payment data.
- Met Office data
- Complete, detailed UK Royal Mail address data
- UK Hydrographic chart data (S57/S100)

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The GC should promote open architecture approaches, including consistent and widespread application of open standards, open APIs and open data.

Agreement on common UK taxonomies and ontologies for geospatial data will enable interoperability between local/regionally developed data models and information systems.

Promotion of Linked Data techniques and related standards (such as the Spatial Things) standard, will enable UK-wide data and information interoperability, regardless of regional data models and information system implementations. .

Similarly, open architecture approaches and open standards will also enable technical interoperability between different (regional) technical solution or implementations.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Coordination can be achieved via

- Establish a national Spatial Data Infrastructure (SDI)
- Encourage participation of local authorities in sharing data into a UK SDI
- Establish forums and communication channels between key local authority stakeholders
- Provision, distribution and maintenance of best practice guidance (such as SDI 'cookbook') amongst key local authority stakeholders
- Establishing clear local authority benefits, e.g. of open data, EO, linked data, etc
- Encourage LAs to join and represent themselves on trade and standards bodies, such as OGC.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Geospatial applications that could be scaled up to address these high-value categories include:

- High volume/velocity streaming analytics tools for real-time geospatial analysis
- Predictive analytics tools
- Geospatial modelling tools, including digital-twin approaches, including as-built data capture tools and processes
- National Infrastructure modelling tools (e.g. NISMOD), which could be adapted to provide model-driven evidence-based approaches to identifying the most appropriate (geo-technology) interventions for future economic scenarios across the industry categories listed here
- Shared national 3D spatial data infrastructure for utilities and public works (i.e. a national BIM resource)
- For property and land in particular – machine learning / machine vision image analysis tools for EO data analysis and feature extraction

Q18: Are there any other areas that we should look at as a priority?

Other priority areas include:

- Security and privacy
- Role of a UK SDI in emerging M2M, AI and autonomy opportunities
- Use of geodata in prosecution, and accuracy, precision and quality requirements
- Risk of geospatial data sharing (e.g. linked data inference and regression attacks)
- Risk of vendor locking and lack of openness, including the effect of Google Maps (and Bing) on geospatial service openness.
- Effect of monopoly suppliers in the UK e.g. OS, ONS, Met Office, UKHO.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We consider the following to be significant trends that will rely on geospatial data:

Autonomous vehicles – including airborne, marine and agricultural. The use of autonomous vehicles and robotics in an agricultural context is regarded as critical to future productivity and food security, though this presents very different regulatory and safety challenges to autonomous road vehicles. Regulation and safety accreditation is not currently being explored in this sector.

5G - There will be regulatory (and technical) challenges around siting and installing the additional masts that will be required.

Linked Data and Semantic Web: Regulation is needed to understand impact of GDPR on derived/inferred information. Linked geospatial data introduces some specific challenges and risks around the potential for targeted regression attacks on spatially referenced Linked Data resources.

Semantic Web & AI – The semantic web will require creation and maintenance of agreed taxonomies and ontologies across a range of business and industry domains. It will be essential for the UK to develop an agreed set of geospatial ontologies (published in standard formats such as OWL) covering a range of spatial concepts, including (colloquial) placenames and addresses.

GDPR – and risks of regression and inference.

BIM – risk and challenges, including potential for a UK BIM for utilities and public infrastructure.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Development of a persistent EO capability would achieve this end, including maintaining a sovereign earth observation satellite cluster, ground segment services, and full suite of UK Earth Observation services (e.g. analysis tools).

Lead work on development on the UK geospatial semantic web, including stimulating update of the Spatial Things standard.

The UK has world class geodata (OS, UKHO, MetOffice), EO capabilities (the Satellite Catapult, UK Space, BNSC), analytical know-how (e.g. NRSC, ONS), and technology sector, yet in geospatial terms, we are somehow 'less than the sum of our parts'. Establishment of a UK National SDI and GEOS would enable us to draw together these constituent parts into a coherent platform that can stimulate development of world-class business and technologies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Possibly comparisons would include

- USA (NGA in particular)
- Singapore

I would also look at international initiatives that have managed to harness cooperation between a range of stakeholders to successfully develop SDI or geospatial capability. For example:

- United Nations (GGIM, for example)
- World Ocean Council and other bodies (World Bank, European Commission) involved in development of the Blue Economy and Integrated Maritime Policy concepts.
- IMO's work developing the Maritime SDI
- INSPIRE

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission
Cabinet Office
1 Horse Guards Road
London
SW1A 2HQ

Email: geospatialcommission@cabinetoffice.gov.uk

24 October 2018

Dear Sir/Madam,

RE: Geospatial Commission – call for evidence

FSB welcomes the opportunity to provide a response to the above call for evidence.

The Federation of Small Businesses (FSB) is the UK's leading business organisation. Established over 40 years ago to help our members succeed in business, we are a non-profit making and non-party political organisation that's led by our members, for our members. Our mission is to help smaller businesses achieve their ambitions. FSB is also the UK's leading business campaigner, focused on delivering change which supports smaller businesses to grow and succeed.

FSB is supportive of the setting up of the Geospatial Commission, recognising the extent to which geospatial data and technology can transform services, improve productivity and drive economic growth through innovation.

A key area for optimisation, and future growth, is the transport sector. Accurate mapping data combined with routing algorithms can produce more efficient routes. This will be especially useful for commercial vehicles and small businesses, to optimise delivery networks. This can reduce fuel costs and increase the productive time conducting business due to less time spent driving. Businesses will also benefit from improved transport routes for consumers, who will be able to access small business premises more easily.

Planning transport infrastructure improvements with more data to hand will ensure a more proactive approach to managing the transport network, enabling a more productive use of existing assets. This will help to maximise the return on investment of infrastructure projects, and better target necessary maintenance. Geospatial data can also be used on wider infrastructure improvements, to support optimal route locations.

In the near future, the wider availability and use of geospatial data could be used to increase competition in the market for autonomous vehicles, enabling a connected transport infrastructure that is responsive to demand. This could unlock the benefits of reduced pressure on transport infrastructure, and also contribute to a reduction in greenhouse gas emissions when combined with electric vehicle technology. The same data will be able to be used effectively by drones in logistics, which could reduce the current pressure of deliveries made by road.

In the wider digital and connected world, geospatial technology could be used in the development of smarter cities. A prerequisite would be a national rollout of full fibre (fibre to the premises, FTTP) broadband, which would allow a similar rollout of new 5G mobile networks. Similarly, with more geospatial data available it should be possible to accurately map the areas of the country that do not have a reliable mobile or internet connection, and direct investment to remedy it.

[Text redacted]

Yours faithfully,

[Text redacted]

Federation of Small Businesses

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Fugro
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The view of geospatial data type seems to be correct. However, it is important to include all the reference frame, resolution and acquisition or processing date.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Promoting more geospatial degrees, in bachelor and masters in order to get more qualified people in this area, which is limited.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Surveyors/Geospatial Scientists/GIS technicians.
These careers can be promoted in caree fairs, geographic and geology conferences, careers adviser in the university could present these options to the students, and interesting a related programes could be created including theory and practice about:

- Positions systems
- Geodesy
- Land and marine surveying
- Data analysis, manipulations of very large spatial data sets.
- GIS

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Hydrographic data from UKHO/ MCA Civil Hydrographic Programme would be valuable to have public and free access no only for non- navigational purposes. The data could be served to generate hydrographic charts, which facilitates creating additional information for the UK marine sector.
Satellites images with high resolution are not free accessible to the public, and these could be useful for a wide range of researches as well as monitoring environment, changes in land use, among others.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Drones to monitore environment and observe any particular issue with more detail in a particular area, and make this data open to the public.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data can be applied to assess diverse issues, it could help to locate the best areas to the expansion of residential areas, best routes and roads, monitoring changes in the environment, such as the increasing or decreasing amount of trees in a urban area, to access the quality and accesability to greenspaces.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector that use gesoaptial data could provide the government with the data they got by their own and they could supply additional information, which is obtained from their analisys and outputs from their researchs and that could be of the national interest.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Medical data, to analys the spreed of a particular diseas or virus in a particular area, or tackle a particular problem as obesity in a area with little greenspace.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Creating webmap applications and websites, containing maps and geospatial data, that can be presented in articles, conferences, etc.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

USA, Canada, China can be taken as examples. USGS provide satellite images and worldwide data, with more detail and higher resolution in USA.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Fugro
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

All Geospatial data needs to be accompanied with definition of its geodetic reference frame and time and an accuracy resolution statement and source of the data. If these are not clearly associated geospatial data is of reduced value

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The UK has a low number of geospatial graduates from degree courses. Particularly with regard to traditional Land and Hydrographic Surveying, for several years we (Fugro) have relied heavily on the availability of graduates from outside of the UK to support our UK business. The promotion of careers in these areas has very limited exposure and the number of candidates enrolling for these courses in falling. This should be a great concern to the commission. This low level of bachelor graduates has a further impact on those going on to post graduate study and further research. The term “surveyor” is very broad in the UK and this creates confusion around the profession. Academic institutions are rebranding using Geospatial but this has limited meaning amongst the wider population. There is not a professional body that covers the “geospatial sector”. This tends to get lost in other professional bodies such as RICS or CICES. However, these organisations have different agenda and do not successfully promote the geospatial profession. (Example being New Zealand https://www.surveyspatialnz.org/ where there is a clear professional body to register and promote profession)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Surveyors/Geospatial Scientists.

- Principles of GNSS and the geodetic considerations of using GNSS.
- Principles of land surveying: network adjustment, transformations and projections, propagation of errors, accuracy and precision.
- Principles of hydrographic surveying: sonar, speed of sound, acoustic positioning underwater, inertial navigation systems
- Data analysis, manipulations of very large spatial data sets.

Clear definition and reinforcement of the “Geospatial” brand. People need to understand and be excited by careers in Geospatial Science/ Surveying.

Move from analogue to digital working practice. Digitalisation across all industries is a massive program. Abandon paper. Focus on the data.

In addition - Skills/knowledge developed organically at “home”

Role of GIS Professionals to manage and control data.
E-Revolution supported by Geospatial Databases and Web Services.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Hydrographic data from UKHO/ MCA Civil Hydrographic Programme should be open for non-navigational purposes. This should be free to download and access in fully attributed form. The underling processed bathymetry data (multibeam echosounder data) that was used to generate the modern hydrographic charts should be made available to industry under license. This would greatly facilitate creating additional value for the UK from the marine sector. Large amounts of tax payer revenue are spent mapping the UK continental shelf (and beyond) yet this data is massively sub sampled to create navigation charts. There is much greater value in this data than just the generation of navigation charts.

BGS data should be fully available in raw and processed format.

Photogrammetric imagery

Utility cables, ducts and pipes - issue with this data is the accuracy. Would suggest that a national mapping program would need to be undertaken to confirm location particularly of electricity distribution cables.

Forestry Commission holds very large quantities of geospatial data that is now publicly available.

OS data.
Free aerial/LiDAR data - already provided to government agencies via OSGB and can be accessed if you are supplier to these clients. OS data made publicly available is of slow spatial resolution (mapping accuracy of 0.2m) and low spatial density. OS should deliver data as a much higher accuracy tolerance and data at full acquired data density.

Network Rail commissioned a National aerial survey in 2014 that collected helicopter based LiDAR and imagery. This dataset is accessed internally within NR using Routeviewer. The dataset would be an excellent resource that could assist with safety critical planning of surveys and as a quality assurance tool for our own data acquisition.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address need to be clearly defined in three dimensional coordinates. With the increases in urbanisation a larger percentage of the UK populations with move into large multi-storey buildings in cities. Future automated delivery solution will rely on being able to deliver to a 3D location and not just a 2D location.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Access to free medium and potentially high resolution satellite imagery and terrain data is moving very fast, Planet recently had launched 88 satellites with medium resolution, WV4 30cm launched as well during November 2016...Kompsat is offering 40cm pixel resolution and Airbus plan to launch 4 satellite with 25 to 30 cm pixel during 2020. Access to this imagery would help develop preliminary design programs more rapidly and free up funds for the more critical pre-construction assessments of the final routes. Would also assist with the monitoring of the projects over time.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Remote Sensing.
Real-Time "temporal" analysis
Machine learning capabilities that can transform raw imagery into data to help people and organisations make more informed decisions.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data is the foundation to all large construction, infrastructure and renewable programs. Without this data the future development of renewable energy, smart grids and smart cities will be difficult if not impossible.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Better sharing of data between organisations.
Better understanding of its value. This information is the foundation but the majority of the time due to its downstream position it can be undervalued and under appreciated. Without this data their is no design, there is no risk analysis/monitoring so why should it be cost prohibited?

Network Rail in particular are guilty of a siloed approach to data asset collection and management whereby individual projects procure and gather data relevant to their project only. This leads to duplicate data and costs and potentially missed opportunities to share data between projects or realise economies of scale through a joined-up approach to merge data collection across projects.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Firstly, the commission needs to be clear that GPS refers to the US Government Navstar GPS system. In industry and academia we use the term GNSS to cover all Global Navigation Satellite System including Russian, Chinese, European and future systems).

The understanding of the geodetic networks underpinning GNSS in generally poor within large swathe of the geospatial industry. This alongside plate tectonics (The earth crust moves relative to the primary GNSS reference frame) means that a lot of geospatial data that has been collected to date is poorly referenced in geodetic datums and in time. The implications of this can mean that the data absolute accuracy may be in error in 100s of metres. Plate tectonics also mean that points move around 2cm per year in UK.

The growth in GNSS for commercial applications (Taxi services, insurance pay per mile, future toll road charging, drone delivery services and autonomous vehicles.) are susceptible to denial of service or spoofing attacks. Spoofing attacks have the potential to overcome these commercial applications. Within Fugro we have a global networking of GNSS tracking stations and we utilise these for commercial augmentation services (improving the standalone real time accuracy of GNSS https://www.fugro.com/about-fugro/our-expertise/innovations/starfix-global-positioning) and authentication services (real time user level detection of GNSS spoofing attacks https://www.fugro.com/satguard)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The geospatial industry in the UK would be hugely strengthened by the introduction of a registered or chartered surveyor/geospatial scientist acknowledgement by a newly formed Geospatial Body.

The current data acquisition and mapping undertaken by OS for the purpose of land registry and property development should be transferred to the private sector. Property owners and developers would then be required to (at their own expense) to commission a registered surveyor to undertake the survey and mapping requirements associated with new development or modification. This survey data would be submitted to the OS for validation and incorporation into a newly enhanced UK wide cadastral property registration system.

Similarly, all civil construction projects would require surveys to be undertaken and mapped by a registered surveyor for on pass to the OS.

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A lot of specialist knowledge exists currently within the private sector. Fugro for example in the leading company for acquiring geospatial data in the marine environment (seabed mapping and seabed sampling) to support offshore energy (Renewables and Hydrocarbon) and hydrographic charting in the UK.

Fugro maps thousands of miles of road, rail and powerlines in the UK for asset integrity purposes.

Fugro is also a leading providing of GNSS augmentation and authentication services globally.

The UK should move away for acquiring data via public sector employees and move to a fully contracted out model where the public sector just manages the

procurement contracts and hosts the data in a portal on behalf of the nation. Data acquired by the government should be freely fully available in raw and processed format to all via online web portal.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Bottleneck tends to be in the supply of the data. An online portal to sign off on the data access and delivery of the data through it.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Conduct research with relevant UK academic institutes to determine the optimised and standardised way of collecting, storing and distributing data. All government bodies go through the same learning and education process yet their data is largely similar
Provide masterclasses in the geospatial technologies and their abilities to solve their problems.
Reach out more to the suppliers and get their input.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Network Rail commissioned a National aerial survey in 2014 that collected helicopter based LiDAR and imagery. This dataset is accessed internally within NR using Routeviewer. The dataset would be an excellent resource that could assist with safety critical planning of surveys and as a quality assurance tool for our own data acquisition.

Cefas owns and operates a vessel that acquires geospatial data within the UK continental shelf. This data acquired is currently not made available to the public in raw and processed form.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Geospatial Commission needs to establish a centre of excellence for the hosting and distribution of data. A UK Geospatial Data Lake. This would facilitate all government departments using the same core technology for their data hosting.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Offshore – to fully maximise the potential of the offshore renewable energy resources in the UK all currently government held data from UKHO (bathymetry, seabed composition, tidal current), BGS (geological and geophysical data) , MetOffice (all observed offshore wind data) should be made freely available. This will reduce the risk to industry and enable a faster transition to offshore wind.

Q18: Are there any other areas that we should look at as a priority?

Creation of a Geospatial Industry body.
- Registration of Geospatial Scientist/ Land and Hydrographic Surveyors by an industry body.

Promotion of Careers in Geospatial Science

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Automotive
-Taxi services
- Insurance "pay per mile" metering based on GNSS,
- Road Tolls -future toll road charging
- Autonomous vehicles (Cars, Agricultural)

Asset risk management – development of proactive risk management work programs

Drone delivery services

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Stronger investment in academic research with UK academic centres of excellence.

More visibility at European/African Industry exhibitions and conferences

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

New Zealand – Cadastral system for property maintained by LINZ (https://www.linz.govt.nz/) underpinned by a surveyor being licensed (https://www.surveyspatialnz.org). Only Licensed Cadastral Surveyors are qualified to certify the legal plans required to define property boundaries for a 'Certificate of Title' to issue.

Texas Board of Professional Land Surveyors http://txls.texas.gov/ . The mission of the Texas Board of Professional Land Surveying is to protect the residents of Texas by regulating, licensing and renewing the licenses of only competent surveyors; surveyors able to provide accurate surveys which will result in the orderly use of our physical environment.

Thank you for your time in completing your response to our call for evidence.

If the commission requires any additional information or further clarification Fugro would welcome the opportunity to present more information to the commission either in person or remotely. Fugro [Text redacted] would welcome the Commission if they were interested in visiting an office to understand more about Fugro and how we acquire, manage and delivery geospatial data services.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:
geospatialcommission@cabinetoffice.gov.uk.
Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Future Cities Catapult
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	Please mark with a X
Academic	
Business representative / trade body	
Central government	

Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	Quango

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Whilst these geospatial types are accurate, the way in which they are presented and explained is not necessarily useful. Positional data is confusing. Usually in the literature, positional data refers to data that are characterised by their coordinates. Location data on the other hand refers to locations, or places on the coordinate plane. These can be Points Of Interest (POIs), landmarks, polygons etc. Maybe a distinction between positional and location data is more appropriate. In all cases it would be useful if examples were given.

This view of geospatial data types critically misses two other essential themes. Firstly the spectrum of Open to Closed data (as best communicated by the Open Data Institute https://theodi.org/about-the-odi/the-data-spectrum/). Secondly the application of geospatial data. Here and throughout the consultation document there is a lack of reference to specific impacts or missions that the commission aims to infuence. Whilst it is understood that the scope of the commission is focused on its partner bodies and the data they hold, the opportunities to deliver value for the public sector and the market can only be achieved through a sharper focus. By communicating more clearly these impacts or missions, the commission will be better able to achieve its objectives of realising the value of data held by its partner bodies.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The list of representative bodies that the commission is intending to engage is too narrow and focuses too much on preaching to the converted. A much broader range of professions could benefit from geospatial data but are not yet fully aware of the benefits and opportunities. Currently geospatial professionals in local planning authorities are marginalised, wielding the most powerful computer in the organisation but mainly using it to name roads. In architectural firms, professional BIM (Building Information Modelling) specialists are creating data rich models of new buildings that float in space due to a lack of geospatial referencing.

The problem is less about geospatial skills within geospatial bodies or organisations, its more about how these capabilities are stuck within narrow professional domains. We believe that professional bodies not representing geospatial skills but with the potential to benefit from more distributed geospatial data and capabilities, should be at the forefront of the commissions thinking. In our experience of developing geospatial digital projects in cities, we believe that engaging and involving the built environment professions (RICS, RIBA, RTPI) will be critical to understanding how and where to extract the value of geospatial data.

As the use of geospatial data grows, there will be an increasing need to focus on skills related to security and penetration testing, advanced and novel approaches to privacy, efficient processing of large geospatial data, and geospatial abstraction.

In many instances it is less about the geospatial skills themselves and more about how they can be allied to other domains so as to communicate and prove the value of geospatial data. It would be helpful if the geospatial commission created a methodology for geospatial professionals and organisations to understand what the value of geospatial data that they hold and how this value could be released if made available to public / private organisations. This would help persuade decision makers understand the value of the data given their focus on financial considerations in organisations.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We are fortunate at Future Cities Catapult to have staff with geospatial skills across data science, land use planning and architecture. However, most of the organisations that we work with have little or no capability and little or no awareness of the value of geospatial skills. Within local authorities, housing developers and commercial real estate developer, geospatial knowledge is either siloed and undervalued or poorly outsourced. If there are skills and knowledge it is difficult to share this knowledge within an organisation, partly due to the way in which geospatial professionals are trained, partly due to the hardware constraints that mean that there is only one computer in an organisation which has the license and power to run GIS software.

By promoting more open GIS platforms such as QGIS and more cloud-based geospatial products not linked to proprietary platform, more people could access and understand the impact of geospatial data.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We noted that this question is subtly but importantly different to the one included in the original consultation document, namely "*How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?".* We feel that the approach of directly asking people for their current view on priority data risks prioritising "faster horses", in that by solely asking respondents which data they need now is likely to miss other opportunities to extract value from geospatial data that may not be immediately obvious.

We believe that the original approach of developing a **methodology** for prioritising geospatial datasets would be more valuable than asking people for their priorities. This is because the most obvious data isn't always the most valuable or impactful. Our experience developing an infrastructure capacity mapping tool in Greater Manchester and Belfast (http://growthplanner.net/) taught us that having a mission or challenge-led approach is far more productive in identifying high value data (in this instance, infrastructure capacity data).

The commission could also have an impact by not necessarily increasing access to geospatial data but also increasing visibility of already existing data. Our Tombolo project (http://visualisation.tombolo.org.uk/) has shown that there is a wealth of high value geospatial related data collected and held by local governments that doesn't get exposed to businesses or individuals. The barriers are many, lack of standardisation, non-existent metadata and data collection mechanisms and lack of semantic categorisation. Specifying a consistent framework that data collection organisations should adhere when dealing with geospatial data is a good first step.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The proliferation of UPRN and USRN should continue and be made increasingly transparent and accessible. Further, technologies that can enable greater detail with respect to specific locations may also be valuable. For example, what three words, or even methods that relate to addresses in three-dimensions will become increasingly valuable not only as improved delivery and accessibility services proliferate but also as the deployment of IoT sensing technologies increases. E.g. 'where is that sensor'. This should also be developed with both internal and external locations in mind. The emergence of blockchain-driven geospatial approaches such as FOAM are also worth considering.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

One good way of opening applications is providing open access to Earth Observation data. Due to the absence of such a resource, many companies are relying to applications such as Google and Bing for satellite imagery to carry out their analysis. The United States Government is a good example of open source satellite imagery provider http://earthexplorer.usgs.gov/

Fundamentally, EO data needs to be brought out from the research institutes. There are already free resources that we need to be capitalised upon. These data sources need to be much better advertised and the use cases around these data also needs to be shared more effectively. It should also be seen alongside HAP's High Altitude Platforms (air balloons) and drones as a cheaper alternative to capturing real time earth observation data, once images could be shared more readily / easily there would be more incentive to analyse these and build analysis skills in this area.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No response.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No response.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The UK currently has s competitive advance in geospatial data and technology but we risk losing this advantage as other countries and companies invest in technology to derive benefit from geospatial data. This blogpost sets out in detail how quickly companies such as Google are able to replicate decades of investment made by Ordnance Survey in a fraction of the time and cost - https://www.justinobeirne.com/google-maps-moat/

One way to differentiate UK geospatial data is by enhancing the quality, in ways that are not replicable by the private sector. For example, how might planning applications require applicants to provide geospatial data, for example the georeferenced location of utility pipes gathered from a site survey? How might geospatial datasets from different public agencies be combined to produce new higher value products?

Another way to differentiate is by the level of investment provided to geospatial data – delivering on the manifesto promise to deliver the worlds largest open land data repository. As increasingly the data infrastructure for places will become as important as the road, energy and waste infrastructure, the public sector should invest in it accordingly. That is not to say that, was with those critical utilities there is not a role for the market but that the public sector is the provider of first resort. Only by owning the source geospatial data is it possible to recoup that investment. Opening data does not mean it is free of charge. Developing business models where geospatial data is free for low frequency users and paid for by higher frequency users, should be a focus for the commission.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

A comprehensive database of georeferenced WiFi access points (SSIDs) along with the associated metadata would increase opportunities for indoor positioning as well as benefiting location-based services depending on activity detection. Investing in a 3D cadaster would also allow for more personalised and detailed location based services.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector should be encouraged (using tax reliefs or other incentives) to contribute to UK's geospatial infrastructure. Mobile network positioning through call detail records or positioning data of mobile phone applications are good examples of a high value private datasets that could be used to enhance the already existing assets.

The private sector could also be required by legislation to open geospatial data that is generated as part of public tasks. For example, Project Iceberg, a collaborative research project between Future Cities Catapult, Ordnance Survey and British Geological Survey highlighted the potential value to be realized by greater sharing of data about sub-surface geospatial data. This can be achieved through developing a data sharing business model but this would be enhanced by greater regulation and legislation that required owners and operators of public sub-surface utilities and assets to share non-commercially or security sensitive data with a public data framework operator. This approach is one that has enabled Belgium's KLIP service to quickly take off and deliver benefits.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We have worked on a series of projects that require assimilation of open and closed geospatial data from different public sector organisation. These projects have focused on areas such as the following:

- Building a tool that makes it easier to collate geospatial data from multiple public sector sources.
- Building a tool that helps to communicate the socio-economic opportunities associated with new development.
- Building a tool to help SME builders navigate the property development process.

Across each of these there have been a number of common challenges with respect to working with geospatial data:

- Highly disparate sources both between institutions and within institutions - each with different ways of providing access.
- Insufficient documentation about what information is available and how often it is updated.
- Insufficient access information relating to how to source the data (e.g. APIs, Downloads etc).
- A lack of access to data in the appropriate standardised formats.

- A lack of standardisation around the collection and processing of geospatial related data.
- Contradictions in ownership, use rights and applications of data.

Remedies:

- The commission could create standards, or best practice advice on how to release data, with the appropriate access options and the appropriate and timely documentation. This advice should be challenge specific. E.g. publishing planning data or data around species at risk.
- The commission could build tools and provide people / resources that facilitate the release of data which follows these standards and enable public sector bodies to adhere.
- The commission should map all public sector geospatial data to enable other to understand what constitutes geospatial data, what exists and where it may reside.
- The commission should clarify suggested ownership structures for the data. For example, all non-personal, geospatial data generated by the public sector should be freely accessible to all other public sector bodies.

Case studies (further detail available on request)

Future plan – Birmingham
Incorporation and extraction of data relating to the housing, economic, social and environmental impact of new development from planning applications.
Why: Valuable information is already being generated through the development process but is often void of valuable detail and is rarely presented in ways accessible or useful to policymakers and citizens.
Suggestions: Mandate the provision of machine readable information in a geospatial formats through government services where relevant.

Gateshead – Small builder de-risking tool
Small and medium size developers do not have the skills and local planning authorities the resources to open and communicate critical geospatial data relating to a brownfield land site.
Why: Privacy and sensitivity of data, together with organisational culture, inhibits the sharing and opening of public geospatial data from land contamination and public availability of data;
Suggestions: Provide guidance to local authorities and public agencies (with the support of the Centre for Protection for National Infrastructure) about what is truly sensitive data and how aggregation and other techniques can protect commercial and security sensitivities.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Be mission led rather than generic focus on geospatial data
- Mass purchase of private data where there is a clear public benefit.
- Support public geospatial data owners how to purchase geospatial data or analysis
- Be a platform for geospatial data (or encourage partner bodies to come up with a geospatial version of data.gov.uk

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We believe that the commission should be more mission focused to enable a better understanding of 'other' geospatial data that would be of benefit. We also believe the commission should have a more active role in stimulating "novel and valuable use cases" so that 'unknown unknown' geospatial datasets could be brought to the surface.

Our work as part of the Future of Planning programme has identified a number of geospatial datasets as critical to the land use planning process, from flooding, to contamination to planning policy. Some of these are viewed as geospatial data but others, such as planning policy, derive new value from being viewed and constructed as a new geospatial dataset.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

No response.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Working through existing institutions such as MHCLG, with existing umbrella bodies such as the Local Government Agency and through intermediaries such as Future Cities Catapult. Most usefully the commission could highlight what geospatial data is already available and accessible to local authorities; tell more compelling stories about the ways in which geospatial data has been used to address problems (and not just int eh public sector examples); and it could provide the funds and/or skills to enable local authorities to better capture the economic, social and environmental impacts of geospatial data projects.

Perhaps the commission could learn from, and collaborate with, a number of related activities which are also seeking to change the behaviour of Local Authorities and support the development of skills. For instance, the MHCLG LocalDigital campaign to “fix the plumbing” and the related Local Digital Fund could be a useful way to reach those within Local Authorities that you’re seeking to influence. It is important to settle on underlying design principles which support these agendas so that there is less opportunity for conflict. Future Cities Catapult has recently developed a City Data Sharing Toolkit for those working in Local Authorities and related local public sector organisations. This is a very high-level toolkit which seeks to help the target audience understand the processes for sharing data and signposting to more detailed. This type of explanatory product would be helpful in the Geospatial space through simplification and reduction of some mystification in terms of Geospatial data. A broader community of people will need to feel comfortable working with geospatial data if the commissions aims are to be realised and this can be achieved by making the issues easily understandable. If carefully designed, this sort of intervention could help develop a community around the issue. Future Cities Catapult would be happy to have further discussion about this with the Commission.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- property and land
- infrastructure and construction
- mobility
- natural resources
- sales and marketing

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The land use planning domain is, as suggested by the name, one in which geospatial data is fundamental. More open, accessible and interoperable geospatial data has the potential to massively disrupt how developers identify land for development, how local authorities identify their priorities for development and fundamentally how we build the right homes of the right quality in the right places.

Future Cities Catapult, working closely with MHCLG, the Scottish Government, local planning authorities and SMEs, had identified a range of use cases, prototypes and digital products where geospatial data is a fundamental driver. However, currently the investment available from central government and the Commission partner bodies is insufficient to truly digitally transform the system. By taking a mission focused approach to investing in innovation, data engineering and digital product development to deliver more homes, the Commission could better funnel activity and investment into this critical area.

The integration of BIM and Geospatial information, as normally BIM models are not compliant with geospatial rules for topology and geometry, but they supply details about the design and behaviour of things. The Interoperability of standardise digitise data between 3D geo-information and BIM can help the planning and operations of the cities and disrupt the AEC and planning sectors. The increased collaboration between ESRI and Autodesk shows that the market understands the benefits of linking building information with spatial information. It is critical that as much of this digital infrastructure is as open and interoperable as possible.

Q18: Are there any other areas that we should look at as a priority?

The above areas of high value impact are correct but are too broad and insufficiently mission focused. Only by taking a more focused and mission-oriented approach can the value of £11bn opportunity be realised. This mission focus should both enable clearer communication of the opportunities associated with geospatial data, to attract greater public and private sector interest in using the geospatial data to create new impactful products and services with.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Many emerging technologies will be reliant on geospatial information, from connected autonomous vehicles to augmented reality. The challenge for the commission, government and industry is to what extent will geospatial data collected by non-government organisations be available or useful to other innovators. Companies such as Google are already by-passing traditional geospatial data providers such as OS to generate their own digital twins of the UK. This may well give their CAV subsidiary Waymo an unfair competitive advantage in bringing their products to the market.

As we see more products and services that use augmented and mixed reality, underpinned by geospatial data, to introduce a digital layer into the real world, there will be challenges in terms of who regulates this digital space.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Better communication of the value of geospatial data in non-traditional ways, as shown in our project Iceberg. There is also the potential to incorporate Geospatial as part of the … is Great campaign.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No response

Thank you for your time in completing your response to our call for evidence.
Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	The Geological Society
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	X
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Also, learned and professional society for geologists.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Geological Society (GSL) is the UK's learned and professional body for geoscience and a major international Earth science publisher with about 12,500 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia, regulatory agencies and government with a broad range of perspectives on policy-relevant science, and the Society is a leading communicator of this science to government bodies, those in education, and other non-technical audiences.

We are pleased to see the government is consulting with those in the geospatial data sector and beyond on how UK geospatial data can be managed, optimised and grown in the coming years. It is also good to see that the British Geological Survey (BGS) and the Coal Authority, organisations where many of our Fellows are employed, are listed as partner bodies on the strategy as subsurface geospatial data is of critical importance to the UK economy and R&D sector. In producing this response, we surveyed Fellows from a variety of different sectors. It was widely flagged that the strategy and Call for Evidence document did not sufficiently cover the full range of subsurface geospatial data and the value it provides to UK Plc. Subsurface data incorporates a wide range of information that is critical for a wide variety of commercial applications such as planning, construction, transport infrastructure, laying of subsurface utility lines and extraction of mined resources, hydrocarbons and groundwater for household use. Subsurface geospatial data is also critical for the use the subsurface in terms of the long term storage of radioactive waste and CO_2. Current UK Government

policy to build a Geological Disposal Facility (GDF) as a long-term storage solution for radioactive waste and also the use of the subsurface for the geological storage of carbon as part of any future CCS development in line with our climate change targets will require and generate a significant amount of high-quality subsurface geospatial data. As it stands, there is little in the way of clear ownership with regards to which bodies or organisations own and manage the subsurface. This lack of clarity often means subsurface geospatial data is not managed, stored or integrated in a useful way.

As many in our sector know, the subsurface is a very busy environment. By way of example, this subsurface map on the British Drilling Association website of a busy London intersection goes some way to outline the hazards that buried utilities and services can pose to subsurface work. There is currently a collaborative project, launched last year, going on between the Ordnance Survey, the British Geological Survey and the Future Cities catapult called Project Iceberg to explore how to better capture, collect and share data about underground assets and geological conditions which has been set up due to the lack of information about the features beneath our towns and cities. The project lists the various challenges of access to subsurface data which includes the limited coverage, data interoperability and quality of the data. Projects such as this are critical to improving access to subsurface data and more general understanding of the use of space in the subsurface and it is important that efforts like this continue.

More detail on the social and economic benefits of subsurface geospatial information along with quantified case studies detailing impact and societal benefits can be found in the GSA special paper on Societal Challenges and Geoinformatics: https://doi.org/10.1130/2011.2482(04).

A strategy for the subsurface

It is the view of some in our sector that the management of the subsurface and the data it holds is in need of its own government-led strategy to enable developers from all relevant sectors working in the subsurface or using subsurface geospatial data to move ahead with clear rules as to the ownership and management of the subsurface. This would also include the significant amount of historic geospatial data held on the subsurface as well as the current data collection going on around the country in terms of monitoring (the monitoring of groundwater flow and chemistry, monitoring of seismicity, near-surface geophysics etc. to name a few) and any future data collected. To date, a lack of co-ordination around historic records from the subsurface has resulted in a patchy understanding of the subsurface which in some areas has resulted in significant damage caused by subsurface hazards such as widespread subsidence in historic mining areas, collapsing shafts etc. A shared database of subsurface mine and quarry plans including abandoned metal and coal mines would be incredibly useful for any future mineral exploration as well as for the potential uses of abandoned underground workings such as the current work at the old coal mines in Eastern Glasgow by BGS to develop the area as a potential low-cost, low-carbon geothermal industry.

There are currently a number of significant planned subsurface infrastructure and energy projects in the UK. These include but are not limited to, Crossrail, HS2, offshore and onshore oil and gas extraction, in particular the planned testing for

and development of shale gas as well as the development of a GDF. Many in the community have signalled that a policy for management of the subsurface and joined-up management of the data it affords would be of great benefit to all the various actors in both the public and private sector that are working in the subsurface. Any policy would mean establishing rules and priorities that would need to be long-sighted and flexible to take account of any future uses and development. The UK Government, through activities like the national geospatial commission, is unique in its ability to create such a strategy and to also create centralised data storage for historic, current and future records and to ensure the holding of common databases that could be used by developers and decision-makers.

Types of Geospatial data

In terms of the view of the types of geospatial data covered in the call for evidence, we are pleased to see that satellite-derived earth observation data and environmental data are listed in the document as well as the inclusion of natural resources as a high-priority area. However, there are some areas of critical data that are not explicitly listed in the call for evidence that we have included here.

Environmental Data: In terms of subsurface data, this can cover a number of important areas such as information about groundwater flow, position of the water table and the location and shape of aquifers as well as geochemical data about subsurface water and fluids, soils and gases such as Radon. This information could arguably be included under natural resources, but as it is not explicitly included there, we wanted to raise it here. Groundwater and aquifer data is critical for understanding and monitoring contamination and accidental spills, particularly the transport of contamination in the subsurface. It is also important for understanding the subsurface conditions around developing activities such as shale gas extraction and geological disposal of radioactive waste. Historic and continuous monitoring data of subsurface water is a crucial part of developing and planning subsurface and surface-level construction and development. Groundwater is also a resource in its own right, particularly in the south east, where the majority of the public water supply is pumped from subsurface aquifers. Groundwater geospatial data is also used in the understanding of the risk posed by groundwater flooding, a phenomenon that was particularly prevalent during the early part of 2014 after the record rainfall that fell over the winter of 2013-2014. Much of the UK's groundwater data is held by the Environment Agency, who should be key partners in any discussions around environmental geospatial data, along with the environment agencies in the devolved nations. More generally, it would be good for the commission to explore the role that other public sector organisations can play in relation to the management of geospatial data.

Geohazard data: This could refer to a number of datasets relating to mapping and understanding of geohazards. This data is key to understanding risk from geohazards and also for the planning and development of housing, subsurface infrastructure and other construction work. Important geospatial data on geohazards could include, but is not limited to, data associated with recent landslips and mass movement, natural and manmade cavities in the subsurface, the distribution of radon concentration, coastal erosion data etc.

Structural mapping: This covers mapping and geospatial information about the geological structure of the subsurface and the Earth more widely such as the location and movement along faults and fractures and how that impacts on the strength and behaviour of the surrounding rock. Again, this type of subsurface geospatial information is very important when considering any major construction or infrastructure development such as railways, runways and housing development. It is also critical information when planning for subsurface activities such as hydraulic fracturing as part of shale gas extraction and the planning for storage of radioactive waste and CO_2.

Geospatial data in geological maps – The Geological Society Map Library

In addition to the use of geospatial data for UK Plc and innovation, geospatial data in the form of geological maps have an important cultural and historical value in that they tell the history, not just of the Earth, but of the science of the Earth. At the Geological Society, we hold approximately 40,000 sheets of geological maps as part of our library collection. The map library aims to make geological mapping available to all members of the Society to the best of our ability as a service to our members. The collection is nearly all paper-based and the bulk of the collection has been collected during the 20th century and into the 21st. We are the *only* lending geological map library in the country and we're only able to do this as we are a membership society and because most of our collection is paper-based. Because most new and newly published digital mapping is either subscription or licence-based (and considerably more expensive), this makes joining the Geological Society one of the only ways that it is possible to access mapping for some areas of the world and indeed our users value us for precisely this reason. .

The number of libraries in the UK that hold these maps is diminishing. Collections held by Universities are being closed and broken up and the paper-based collections of many companies have been disposed of and transferred to digital, decentralised stores that can't be claimed to held entirely within the UK. Much of value has been lost in these closures and disposals, both in terms of the original material and the metadata that recorded what was held.

Our users cover a wide range of industries and other sectors. These include exploration of all types, engineering, geoconservation, education, research and even art and culture. Examples of specific uses include tenders for large engineering projects around the globe; support for refugee camps in terms of obtaining water supplies; development of new hydrocarbon, mineral and even gemstone plays; promotion and conservation of geological heritage around the country; research for legal and insurance purposes on specific cases; archaeological research in ancient history; undergraduate and post-graduate student projects; we've even been approached to assist with the creation of the UKs entry into the Venice Biennale.

The one big demand we have that we cannot currently supply is for digital mapping for use in GIS datasets or just as stand-alone images. Although recent copyright changes have meant that we can scan our maps for preservation purposes, we cannot legally allow digital scans to circulate in the same way that a paper map can. Until a map loses its copyright protections because of its age, there's little we can do to use it in a library context. Should that change, the biggest hurdle would be obtaining the resources we would need to exploit the

collection to its fullest potential. We have approximately 3,500 of our maps digitised at good resolutions but do not yet have the metadata needed to accompany those images beyond what is on our library catalogue. To scan the rest of the collection and create metadata to make it discoverable and versatile in its usage would require investment of an order we have not historically been able to meet alone. Before this however, the legal difficulties surround copyright must be resolved.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In geoscience, the majority of undergraduate students have the opportunity to learn how to use GIS systems and in many degrees this is a core part of the course. However, it has been reported to us that the quality of education regarding the underlying fundamental theory is not always of a high standard. For example, many people can produce maps from a GIS programme, but not all could necessarily explain the merits of different map projections or how spherical geometry is applied to calculate accurate distances along great circles, small circles or rhumb lines. In terms of an emerging skills issue in the field, it is somewhat analogous to the situation that developed with computer skills (now being addressed) where many could use advanced software but few possessed the coding skills to write and improve it. Effective use and growth of the UK's national geospatial data assets will require access to effective technical training for a wide range of people, including those in geoscience.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

N/A

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

As detailed in our answer to Question 1, one of the complicating factors in efficient and effective use of subsurface geospatial data is the lack of clarity over who owns and is responsible for activity and therefore data pertaining to the subsurface. Additionally, there are a number of different organisations and actors in the public and private sector that hold geospatial data on the subsurface. Our Fellows reported that it would be good to see private sector organisations such as construction companies and environmental consultants working collaboratively with organisations such as the BGS to unlock and share site investigation data that is currently unavailable. It is thought that as much as 80% of subsurface ground investigation data is tied up in this way and release of this information would be of huge benefit to UK plc and the research community if it were to be made accessible. It would be of significant benefit if the commission could encourage either the mandating of public funded projects to release this data and/or fund a project to manage and deliver this data.

As holders of one of the largest collections of geological maps, it is worth noting here that there are a number of maps that haven't yet been digitised. This is partly because of the difficulties around digitising historic geospatial data within the remit of current intellectual property laws, especially with orphan works.

We are pleased to see that marine geospatial data is listed as a core part of the geospatial ecosystem. In terms of the marine datasets that are still lacking we wanted to highlight the fact that high quality bathymetry (multi-beam echo sounding survey) is still lacking for large tracts of ocean floor around the world. Bathymetric data forms the basis of nautical charts used by a wide-range of marine vessels to ensure safe and efficient marine transportation. Bathymetric maps are also used by research scientists to understand more about the effects of climate change on the environment. They provide key information on dynamic systems such as sea-level rise, subsidence and beach erosion.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

N/A

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

In the UK, we have the full value chain for Earth Observation: satellite builders, expertise in using the data (and developing new uses for the data such as high resolution 3D terrain modelling) and industry that wants to use the data such as oil and gas, mining, environmental monitoring, infrastructure etc. This expertise and business can be sold domestically as well as exported thereby supporting many aspects outlined in the Industrial Strategy. A step change in recent years has been the increased availability of free satellite data. This dramatically increases the uptake of the data and allows business to use the data to add value and therefore support the UK economy. Real time monitoring and imaging of the Earth's surface is an area of research where there are increasing applications that could benefit a wide range of industries.

Significant progress has been made through the European Commission's Copernicus programme which is made up of Earth observation satellites as well as in-situ sensors such as ground stations, airborne sensors and seaborne sensors. High resolution time-lapse images, video and radar imaging (that can 'see' through cloud cover) of the Earth with a high degree of granularity have a wide variety of applications, and produce big data that holds an enormous amount of detailed information about detectable changes in the atmosphere, in the oceans, on the Earth's surface and in the shallow subsurface. There is also a lot of scope for detailed low-level earth observation using drones.

These types of monitoring can create geological dynamic information that can be used to address a number of societal challenges. Information about these changes is invaluable to engineering companies working in the subsurface, large-scale housing or industrial development, exploring for and understanding unconventional fuel sources and monitoring seismicity for the development of hydraulic fracturing and the construction of radioactive waste repositories. The volume and quality of satellite data and applications to use this data are therefore increasing. However, the value of this is limited if we do not have the infrastructure to support the exploitation of the data. As technology advances and the capability for the type and frequency of all geospatial data collection improves,

there will be an increasing demand to store and service large data sets. This will require the development of cyber infrastructure that can support the archiving and sharing of large data sets such as those collected by satellites.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

N/A

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

N/A

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Several questions in the call for evidence seem to stem from an underlying question along the lines of 'How can these data sets be commercialised?'. There is a tension here because if the aim is for people to make use of data and to maximize the amount of energy in the sector so that the UK becomes a world leader, the key is to make as much data as possible free at the point of use. Many suggested that the way to resolve this would be for the emphasis to be placed on commercialising data products rather than the data themselves.

In terms of investment, for near-surface geophysics research, there is a significant lack of funding available. The majority of research themes covered by the relevant research councils focus on solid and whole Earth studies but the near-surface is where our utilities and resources are located as well as being the area directly below where we live and work and so the lack of prioritisation in this areas is a quite limiting. There are some research calls in some engineering councils and the BGS have a strong focus on this area but academic research funds are few and far between, the result being that there are very few PhD students and postdoctoral researchers working in this area. This has a knock-on effect on the commercial sector of near-surface geophysics in the UK. This is in contrast to our European neighbours, specifically Denmark, the Netherlands, France etc. where they are much stronger than the UK in this research area.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Also, see response to question 9 above on near-surface geophysics research in the UK. There are clear commercial advantages to this area of work and research but very few research funding calls available to UK researchers.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As flagged earlier in our response, working more collaboratively with public sector bodies to understand and achieve data coverage and interoperability, particularly through initiatives looking at mapping and understanding the subsurface.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

N/A

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

N/A

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

N/A

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

N/A

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

N/A

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Natural resources:

Property and land, infrastructure and construction and natural resources all have a subsurface component that needs to be front and centre of any data strategy. This could be more easily achieved if there was a UK-wide subsurface strategy that covered the supporting functions, uses and data provided by the subsurface as well as more clarity on the ownership and responsibility of the subsurface. This is covered in more detail in our response to question 1.

Q18: Are there any other areas that we should look at as a priority?

N/A

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

N/A

Q20: How best can we make the UK's presence in the international geospatial world more visible?

N/A

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

This is not an international example, but UK archaeologists hold an online system for geophysical data collected in their discipline which includes data repository, metadata and contact details. This could be a useful example in designing any centralised data storage/strategy.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Geological Survey of Northern Ireland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Public Sector Research Body**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The skills required for the geospatial sector to be fully utilised include, not just the ability to operate GIS systems but, computing, programming and databasing to build databases, create and maintain catalogs of information and programme innovative software. With the move toward Machine Learning and AI it is important to note that this still requires experienced scientists to test and prove software and solutions.

Geospatial skills should become more widely taught in schools to embed GI from a yound age. In order for this to be effective it would be necessary to add compulsory GI to the school curriculum at both primary and post-primary levels and provide the necessary resources to support teachers to deliver this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- There is a need to bring researchers, public bodies, industry and NGOs together in order to set an applied-GIS research agenda and set about finding innovative solutions to organisational and societal challenges.
- We would propose to establish an NI Centre of GIS Excellence involving a Public, Private and Academic partnership to train a sustainable supply of GIS graduates, address key research questions; commercialise new software and utilise AI capabilities, host Knowledge-Transfer-Partnerships provide careers advice and assist stimulate a cross-sectoral, cross-cutting GIS partnerships and symbiosis.
- Link to NI Programme for Government, NI Innovation strategy, NI Industrial Strategy, Matrix NI etc etc.
- Work with Strategic Investment Board to harness existing capability and skills gaps.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

AD - Information on the sub-surface (in the form of Site Investigation reports containing boreholes, lab tests) is acquired and held by developers and consultants for both private and government contracts. Access to these data are often limited to voluntary deposit to the Geological Survey. Unknown ground conditions are one of the main causes of overrun on infrastructure projects. Increasing access to the existing data would help to reduce this.

There are examples – Glasgow, Wales and recently in Northern Ireland where conditions of contract have been used to require the deposit of government procured site investigation information with the Geological Survey however this only addresses a small proportion of the works being undertaken.

In the Netherlands, there is a legislative requirement for information on the subsurface to be deposited with the TNO (https://www.tno.nl/en/focus-areas/ecn-part-of-tno/roadmaps/geological-survey-of-the-netherlands/geological-survey-of-the-netherlands/bro-the-dutch-key-register-of-the-subsurface/)

It is essential that as our underground space becomes increasingly conjested (utilities, heat exchange, water supply etc) that there is a properly maintainted and managed register of assets. For this to operate properly this will require data held by private companies being integrated into an national asset register to inform planning decisions, environmental protection and economic development.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- 3D mapping to fully integrate addressing (multi-occupancy).
- Link to BIM
- Awareness of 4D modelling including real-time monitoring of the subsurface.
- Potential to use the next iteration of Spatial NI or NI Planning Portal as platform upon which to hook different datasets to facilitate integration of multiple datasets depending on different data user persectives.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- Commission should act as a broker to provide access to analysis-ready data.

Using EO data often requires vast computer resources and specialist skills to prepare datasets for use. An EO hub where analysis-ready EO data can be accessed would open up the use of EO data to smaller sectors who lack the computing or specialist skills to incorporate EO data into their business.

An EO hub where small areas of pre-prepared data could be cookie cut and downloaded would reduce the storage and processing required by smaller endusers.

Current EO data costs are prohibitive so reseachers have to access older data; something to address this issue would widen the possibilities and applications.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Don't develop technologies in-house instead provide funds for third parties to develop these instead to address specific 'challenges' set by Commission utilising capabilities available in the marketplace.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Balance. Not all OGL + Private Funding (licensing) + GVT Funding

Unless there is proper maintenance, development and innovation, geospatial data assets will stagnate and what was once cutting-edge and relevant will become outdated. There is a need for sustained and continued advancement, refinement and improvement of datasets and data quality.

Initial upfront funding to open access to datasets may lead to users realising and adding-value to geospatial assets but without subsequent investment to the core assets they will become out dated. There needs to be the recognition that to remain a geospatial leader the UK government will need long term investment in the UK's geospatial assets.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- Attributed 3D
- Driverless cars
- Access to supercomputing

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- See Q7.
- Don't develop technologies in-house instead provide funds for third parties to develop these instead to address specific 'challenges' set by the Geospatial Commission utilising capabilities available in the marketplace.
- Commissioned bespoke solutions to Central Government

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Communication
- People don't know where data is.

It is recogniseable that there is a significant communication issue when it comes to Geospatial Data. Data can be hard to find and is often served from individual websites and webservices, often in inconsistent or incompatible formats.

Spatial NI does well to collate and serve to NI Government and Local Authorities data from across the public sector yet even with this in place there is still a need to inform users that (a) the service and (b) different datasets exist or become available.

For example, the recent Local Development Planning process in NI has shown lack of understanding in what data is available and where to get it and varying degress of capability to integrate it with host data for greater and wider benefit.

One consideration could be for on the fly translation (similar to FME) of data from one format to another or from one projection to another. This would enable users to determine the format and projection that they would like to receive data in.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Unique IDs
- Legislative requirement
- Inclusion of Geospatial Data, Software and Equipment on GVT procurement

The Geospatial Commission could use its buying power and provide a service to a negotiate better rates for collection of data. E.g. contracts for LiDAR, specific aerial imagery and other surveying could be included on government procurement contracts. Informing parties who use e.g LiDAR of commissioned surveys may enable for additional data / areas to be collected at the same time leading to a reduction in cost.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

- Utilities
- Subsurface
- Satellite
- Realtime
- Medical

The Northern Ireland Mapping Agreement (NIMA) provides access to Public Sector mapping in Northern Ireland. As part of this it also enables other parts of NI government to share their mapping data (with access restrictions if necessary) through Spatial NI. In doing so this provides NI Government bodies and LA's with ready access to each others data. Spatial NI is a service that could provide a good model for the other parts of the UK.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- Bring the best bits of the Devolved Administrations as examples of case studies e.g. Spatial NI,

The GC should look at the parts of the Devolved Administration's existing strategies that are effective and use those as case studies when developing a UK Strategy. Given the partner bodies of the GC do not operate in Northern Ireland it should be very much up to the Devolved Administration in NI to decide what parts of the UK strategy it might choose to include when writing the new NI GI strategy (the existing NI GI 10 year strategy ends in 2019).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- 2 way flow of info /data between Central Government and Local Authority.

Experience in NI has identified that education is necessary to ensure that data is used by LAs. Information flows from Central Government to Local Authority but less often in the other direction.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Scale up Spatial NI
- Central web mapping services.

Spatial NI could be scaled up to other regions of the UK.

Tellus data could be acquired for other regions of the UK to identify natural resources and acquire an environmental baseline; these data are of relevelance to numerous sectors and have resulted in c.£100M in mineral company exploration programme spend.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- Use of medical data with other datasets to identify populations anomalies, issues or areas of good health. Ethical considierations are required to permit, release, share, work with and publish this data.
- Distribution management approach to NI transport infrastucture network to optimise total NI school bus journeys/costs/carbons/capacity.
- 3D models of all NI schools within prescribed areas to consolidate school places available and reduce total estate costs.
- Increased abstraction of groundwater or heat in ‘catchments’; assessment, licensing, monitoring and regulation of. Subsurface ownership issues.

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

Perhaps consider partnership with ESRI, Google or NASA or similar organisation on a project of mutual strategic interest.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

TNO – for collection and management of sub-surface data (boreholes). Legislative requirement results in an increase in data collection.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	GeoLytics Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It"s broadly accurate. Inclusion of a temporal dimension might be beneficial: spatio-temporal change is of relevance to a broad audience.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I have no opinions on this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

I have no opinions on this.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The release of raw sensor data that underpins interpretative results. This can include

Topographic data
- due to restrictive licencing

geophysical/geotechnical data
- undergroud asset surveys
  - There was a National underground Assett Group proposal to do this
- heritage surveys
- geotechnical surveys

environmental monitoring data
- soil and plant based
- Other precision agriculture data

Airborne/satellite: (multi/hyper) spectral and LiDAR
- Especiallty Research Council and O/S data

Spectral libraries

[Text redacted]

The OS are walking a tightrope: high quality data that is useful for business decisions comes at a cost. The OS must have the income stream that continues to provide this quality (on the understanding that this is the quality that downstream users require for their operations). Unless this money is provided as *core* (government funds) then the OS have to raise this money (through their trading fund status). The OS, therefore, has to restrict their output in order to protect their asset. However, it should be made clear that whilst aspects of the data are open and aspects of the data are free they are ultimately restricted. This has an impact on re-use.

Raw sensor and supporting ancillary data should be routinely relased (under permissive re-use licences) and made available for formal and informal processing and derivation by individuals and/or organisations.

This provides a rich library of resources from which formal and informal products and services can be created that satisfy a range of markets from general to niche.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

I“ve got lots to say on this!

Many businesses are driven by addressing and other locational concepts. Whilst the AddressBase family describes itself as the canonical addressing system for the UK, it has issues and is not fit-for-purpose for all applications.

Each address in ABP is associated with a Unique Property Reference Number (UPRN). A UPRN can be used as a core reference geography to support address attribute interoperability within and between organisations. ABP reflects the concept of address used by the content contributors (Royal Mail and Local Councils). For these organisations an address represents either:

1. a place where mail is delivered or

2. a geographical asset of interest to a council.

Hence, while ABP represents the superset of addresses used by the Royal Mail and Local Councils it does not represent the set of all addresses used in the UK. Addresses that fall outside the *operational use* of the Royal Mail and Local Councils do not appear in ABP. For example, a sewerage works is a substantial physical asset that is outside the operational scope of a local council or the Royal Mail. It, therefore, does not have an address in ABP. However, sewerage works are clearly of interest to utility companies and the land register as either an operational asset or an area of land with associated rights of ownership and use.

Furthermore, the *lifecycle* of an address becomes critical, particularly for those businesses that deal with properties before they are allocated a formal address (land registers, builders, utilities and banks).

It is not always possible to predict what an address in ABP will look like: it is dependent on the underlying street gazetteer and building naming conventions. One can definitely not predict the UPRN for a new address. Without the ability to create (mint) UPRNs those affected businesses have a data management issue.

Finally, if a *formal* address requires a street gazetteer and building naming to function, one can clearly not give an address to something that does not have a street or a building name. For example, a parcel of land.

To improve re-use Addressbase should consider the following areas:

Documentation

This can be improved. Further thought should be given to metrics that provide increased credibility (such as why some Royal Mail addresses don't exist in ABP and if there are differences between a spatial and TOID join)

Improvements include consistency between authorities and data collection (transparency about differences is important for customer use), quality measurements (against a set standard) and coverage focus e.g. urban/rural postal/non-postal

Transparency.

The code should be published which extracts AB+ from ABPremium

Lifecycle

There are significant issues at the birth and death ends of the lifecycle. Some organisations (such as Land Registers, Utilties, Banks, etc.) have better change intelligence at these areas. This also poses certain challenges for decision making

How can credible organisations mint their own UPRNs

Bearing in mind that a UPRN is in and of itself a licence free object - surely the algorithm to mint a UPRN should also be available to credible organisations

Fitness for purpose

The addresses in GeoPlace are a subset of all potential addresses in that they represent the business cases of

Asset management for councils

Parcel delivery for the Royal Mail

Feeding back problems

How can this be improved

What can and cannot be realistically be achieved with feedback

Quality

Further information on quality of the following attributes would be useful. There is variability across councils, understanding this variability will lead to better decision making

Lag

Spatial

RPC matching

Attribute

Variability

Consistency

Certainty

Furthermore, are we to see any Service Level Agreements in place about update times (especially concerning in the ongoing austerity)

Future proofing

How will UK addresses respond to challenges around

3d

Room based addressing

Arbitrary addressing

Drone delivery

Is the concept of an address overloaded?

Does it carry too much weight?

How can we refer to more arbitrary areas of space?

How much longer will the use of streets and buildings for addresses remain relevant?
Flatted buildings
Relationship between UPRN and VOA

ABP is likely to be the dominant formal addressing system in the UK in the short-term but it is likely to be heavily disrupted. Issues with formal addresses (national in scope, not predictable and relative to underlying street/building infrastructure) have resulted in the development of a number of informal addressing systems that challenge traditional addressing. Algorithmically driven 'addresses' (such as What3Words or Open Location Code). These addresses embed spatial content into the address itself. By using an algorithm to convert the address back into a lat/long position such systems provide spatial interoperability. These informal addresses represent activities involving people and place - but with an emphasis on the latter. As such they can be considered to represent a locational concept.

There are a number of challenges associated with such global frameworks - the key issues revolve around arbitrary area representations, elevation and licence constraints. However, there is the potential that algorithmic address systems will become the dominant addressing system during this century.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Release under clear licencing frameworks that facilitate reuse.

Maintain land-use dictionaries and mappings (as 5 star open data (and ultimately as ontologies))

Develop workflow processing engines

Spectral libraries

Automated change detection at a variety of granularities (urban/rural, speciation to growth dynamics)

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Licence management technology (licence calculus). It is inevitable that new products and services will conflate multiple data. The data sets may run into the thousands. These data will be released under different licence conditions that will affect how downstream products can be created, exploited and licensed. Currently the management of such processes is not transparent. This makes it difficult for licence holders to levy appropriate re-use fees and to ensure that product derivitives are being used in ways that comply to all the licence constraints demanded by the upstream data files (for example a product put out for sale may incorporate aspects of a data-set with a „non-commercial“ licence clause). Such an application will facilitate pass-through data charging to licence holders and increase credibility and provenance of re-useable data.

Internal positional triangulation from wifi, or other, networks. GNSS is ubiquitous. However, the signals are too weak to penetrate building effectively. Within building X,Y,Z positioning has been proven possible.

Improved sem-web and general spatial semantics. The hamstringing of the O/S sem-web research strand is regrettable. This bootstraps early styage research and innovation.

3D is more than BIM! Whilst infrastructure management is important the 3D landscape is more than just BIM. Further research into and exploitation of 3D topological techniques should be encouraged. This would allow the improved representation of geological stratigraphy, near surface infrastructure (pipes, cables etc.) and facilitate improved thermal modelling at a local and regional scale. From a conceptual level it would build a bridge between 2D and 3D concepts (such as an address UPRN and a valuation office hereditament: there is clearly a close conceptual relationship between the two – but this breaks down in terms of the data models).

Increased cross-over of multi-sensor algorithms into the mainstream for static and dynamic data processing (SLAM for example). This could be particulraly beneficial for inferring depth from subsurface utility surveys (for example).

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

See above – there“s not really that much difference between these two questions. It depends on what you mean by „new“ and „future“

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

This is a poorly phrased question....

IMHO, the key issue here is related to the sentence: "This means that their business models need to enable them to maximise the opportunity for users to gain value from the data, while also supporting the sustainable and and up-to-date development of the geospatial assets that they hold."

There are a variety of push and pull factors related to this. In addition whilst there is clearly a need for the public sector to innovate the problem here is with the unknown unknowns in terms of how the sector should innovate outwith its public task and how, organisationally, they might become another link in larger data consumption chains. This will inevitably reflect the complex data workflows that the public sector share with the Ordnance Survey. Of particular relevance are the Land Registers and how topographic (OS) change impacts on registration extent (representing legal ownership).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The data collection and support frameworks mentioned above are all critical. In addition there are the data exposure and re-use frameworks. Improved access to co-ordinated repositories which can expose metadata (to facilitate discovery and re-use) and data streams (to facilitate realtime chaining).

Co-ordinated repositories will allow increased access to „restricted“ data during emergency response scenarios.

In addition it is suggested that formalised statistical data analysis methods (as published by ONS) are supported by exemplar implementations in different data processing environments. This will provide an unambiguous credible implementation of the method which is repeatable and transparently demonstrates to the community the underlying rigour in any analysis.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

I have no opinions on this.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

standards to improve consumption/interoperability
- Formats
  - non-proprietary re-useable formats (csv etc.) to
  - self documenting formats (xml, json, rdf)
- Vocabularies
  - internal
  - domain agreed
    - Ontologies?

SKOS?

persistent

web publication using an immutable address so that the link can be used as a key in your database

Licenses to facilitate unambiguous re-use

Open data through to

Closed

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Government organisations should examine ways in which the data and services they manages can have greater societal impact beyond the core remit through open and commercial (value add) service streams. Some of this is a response to the transparency agendas promoted by national governments (open data) and the European Union (INSPIRE) designed to increase stakeholder access to national data and to catalyse the 'knowledge economy' (as amply demonstrated in the 2017 Conservative election manifesto). This means the derivation of new data products and services. Some of these products and services could be access under commercial licences which would provide alternative income streams.

The use and re-use of these products and services will be framed by licences. Licences will be produced on a product by product basis and, wherever possible, are likely to be based on standard licences (i.e Government or Creative Commons licences). Clearly, when any of these data products re-use content provided by the OS then any downstream product and licence must be compliant with any upstream licence. In this regard the current OS licence is problematic.

The OS is well known for the vigour with which it protects the intellectual property inherent in its data and how restrictive its licencing conditions are. This is appropriate given the quality and investment in the products. However, the suite of fragmented licencing models are complex (even Byzantine), some of which claim viral intellectual property ownership on any derived data. The complexity of these licences means it is difficult to determine what can and can not be done with any resultant derived or conflated data product.

For example, the spatial description of rights in the Land Registers is heavily, almost exclusively, reliant on OS IP. It should be remembered that the capture of the spatial extent of ownership (which is not always the same as a property extent) is the public task of the Land Registers and the exclusive use of (and update against) OS data to support this activity was mandated by the enabling legislation. Hence, the terms associated with OS licences are crucial to Land Register in terms of the delivery of their public task and how they spin out any value-add data derivations. The manner in which OS data is processed (inferred,

conflated and generalised) and integrated with Land Register IP is therefore critical in terms of what can be done with downstream products.

Whilst framework aggreements, such as OSMA, do identify differences in using something which copies from OS IP and something which infers from OS IP (see the section on 'Free to use' of the OSMA licence (page 3) and the examples of 'Free to Use Data'). The application of this clause at scale has been questioned. Clarification and simplification of the OS licences is encouraged: preferably aligning such licences to CC or OGL. This should have specific focus on derivation. There should be further licensing provisions put in place for those public sector bodies which require to use, re-use and derive primary content in the pursuit of their public task. Such organisations need to have clarity surrounding what rights they have to pursue their public task and to commercialise value-add data products and services. It is imperative that senior management have the ability to take meaningful and accurate data licence decisions in an autonomous and timely manner without having to refer back to the OS for clearance.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

This is a fishing exercise. I suggest you conduct more focussed user surveys.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

This is a fishing exercise. I suggest you conduct more focussed user surveys.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

I agree this is an important question. But it is too opern ended. I suggest you conduct more focussed user surveys.

For example:

Co-ordinate Land risk/benefits. This can run from rights/responsibilities arbitrated by the land registers through to potential/opportunity maps (for example: heritage potential – a model to based on partial data to indicate the heritage potential (and then cost/risk) which would be associated with mititgation during development).

Q17: Are there any other areas that we should look at as a priority?

This is a fishing exercise. I suggest you conduct more focussed user surveys.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

This is a fishing exercise. I suggest you conduct more focussed user surveys.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Open licences.

Rich and relevant well structured metadata.

Metatdata and data released through well managed resource discovery portals.

[Text redacted]

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Open data: US

Data curation: Zenodo, RDA

Processing transparency: Open Science – Professor Cameron Neylon

Licencing: Open Science – Professor Cameron Neylon

[Text redacted]

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Geospatial Commission: Call For Evidence Response Questionnaire

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Geomatic Ventures Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No comments

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In light of Brexit and UK national security we should ensure UK academia is well resourced and well funded to provide Geospatial skills for the future including GNSS and speacialised Earth Observation such as novel InSAR techniques originating in the UK such as ISBAS. This should also include the promotion, provision and accreditation of Continued Professional Development courses.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a shortage of homegrown GNSS and InSAR specialists in particular. These technologies should be promoted more effectively through STEM ambassadors and careers events.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Public procurement of novel datasets such as the UK relative land deformation map produced using the ISBAS processing technique from Geomatic Ventures Limited & underpinning of the ongoing updating of the dataset on for example a biennial basis with managed access to UK public sector would be beneficial.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes, investment in new sources of data e.g. home grown satellite missions and other sensors. Stimulation of the industry is required and the Geospatial Commission should provide influence and steer

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Development of a UK InSAR capability; maybe through the next iteration of NovaSAR. Exploitation of novel processing techniques that for example enable complete land coverage of all land-class types should be taken into account during the design phase.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Access to new and improved datasets for the good of the public sector. A good example of this is the ISBAS InSAR processing menthod that provides good coverage ove all land cover types.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

As mentioned in the answer to Q6: Development of a UK InSAR capability; maybe through the next iteration of NovaSAR. Exploitation of novel processing techniques that for example enable complete land coverage of all land-class types should be taken into account during the design phase.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public Sector organisations, perhaps represented by the Geospatial Commission or at least encouraged by the Geospatial Commission could join together to use their combined budgets to procure data-sets for the good of the public sector. Perhaps special purpose vehicles to enable the single – tender of data where it is appropriate and there is no identified competition.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Enhanced multi-GNSS and 5G enabled Network RTK infrastructure across the UK.
A UK controlled and managed equivalent of the EU PRS system.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Public procurement contracts.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

No

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It can actively engage and promote new UK technological breakthroughs such as the ISBAS InSAR processing method.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

No Comment

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Ensure that regional representatives are engaged from across the regional academic and public sector.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No comment

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

InSAR ISBAS processing invented by the University of Nottingham and developed and exploited through Geomatic Ventures Limited is a real example of a cutting edge technology that can be leveraged and scaled up to provide new insights as a data set for property and land, infrastructure and construction and natural resources monitoring. The technology provides surface motion results over all classes of land cover.

Q18: Are there any other areas that we should look at as a priority?

No Comment

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Where there are environmental risks identified and a lot of public scrutiny, regulators should be encouraged through legislation to take account of new technologies for identify environmental factors. As an example, the ISBAS InSAR processing method is the only technology that provides actual values of land motion over all classes of land cover. This technology as an example could be harnassed to monitor land motion caused by industries that affect surface motion in the UK e.g. mining, onshore oil and gas, flood defences, large infrastructure projects and installations (e.g. HS2, smart motorways & smart cities) etc.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Create an active programme for promoting international trade and inward investment. Encourage and incentivise geospatial champions from different academic institutions and regions representing specific technological areas of strength sch as GNSS to engage. Promote leading edge emerging technologies that represent the best of British through the Geospatial Commision e.g. ISBAS InSAR processing.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Access to free Satellite data from the Sentinels (EU) and Radarsat (CN)

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	GeoPlace LLP
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Partnership between local government and Ordnance Survey**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We consider the data types to be accurate.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We support the aims outlined in the Strategy Consultation document for supporting innovation and developing skills in the sector. We note that there is no mention of developing skills at a younger age through Secondary School education, particularly as part of the National Curriculum. We understand that developing GIS skills is specifically mentioned in Key Stage 3 and at GCSE and A Level, but various studies have shown that computing, data and software availability and teacher knowledge and skills vary, and this results in variable access to this learning. Teaching of GIS in relation to other technologies such as database and web technologies could also be a further area of focus at Secondary Education level. Moreover, focus on GIS and tools is only part of the picture. Geospatial information skills involve significant understanding of 'data logic' which would appear to be a gap in capabiiity.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Our experience is that it can be difficult to attract universal skills (web, database and IT infrastructure development; people management; marketing) to what appears to be a niche sector when often competing with finance / banking / commercial sectors who can offer higher salaries and apparently more mainstream.

Geospatial information skills involve significant understanding of 'data logic' which would appear to be a gap in capabiiity.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

GeoPlace and its predecessor organisations have had a great deal of experience in collating datasets from multiple sources, so fully appreciates the challenges in data standardisation, intellectual property rights/licencing/commercial frameworks, technology and people engagement. In our experience, there are several key datasets that, if managed/collated centrally, could provide significant value to the UK economy:

- Address data with Royal Mail IPR: PAF is maintained independently from the National Address Gazetteer (NAG). There is a duplication of process which results in the need to match PAF to the NAG which in turn adds significant cost into the UK economy. PAF is a regulated Royal Mail

activity. This model is potentially a barrier to the success of proposals for release of open UPRNs and coordinates. Removing this duplication by combining the supply chains and establishing a single combined address source could improve quality and create a basis on which to consider new access and licence models to this data.

- Local Authority ID codes and official names: Each local authority should be assigned a unique code and have a standard name reference. This aids the definitive identification of an authority for spatial referencing and other public sector administration activities. Currently this is managed by MHCLG but it has been challenging to identify the responsibility considering the next round of local government re-organisations. Because of the lack of central management, a number of other application specific codes and authority names are in use (VOA, ONS, GDS etc). It would be helpful to add rigour to the process of referencing authorities and promote the use of standard conventions
- Street Naming and Numbering information: GeoPlace has put in place contractual process with local authorities for the collation of address information centrally, however, there is a lack of consistency in the underlying Street Naming and Numbering functions at local level:
    - There are multiple legislative schemes that apply
    - Charging powers aren't clear
    - Consultation on Street Naming and Numbering isn't clear
    - Recording of decisions is not 'digital'
    - There is no direct legal link to Planning, Building Control, Taxation functions
    - There is no framework for ensuring the 'official address' is used locally or across the public sector

  Support to ensure local consistency is required.
- UK authority boundary inconsistencies (process and mapping scales,): Local authorities determine their boundaries predominantly at 1:1250 scale. These are sent to the Boundary Commission for enactment but published by OS at 1:10,000 scale. This generalised scale loses significant detail for spatial data capture and analysis. Improvements in the process would be welcome. Additionally, locality boundaries are not subject to any legal definition which results in ambiguity in spatial referencing (eg Hammersmith and Fulham). Boundaries are further complicated where administrative boundaries do not align – 'There are many different geographic unit types (administrative, health, electoral, postcode etc) and their boundaries frequently do not align. A range of geographies are liable to frequent revisions. The UK's inconsistent geography has made it extremely challenging to produce and compare meaningful statistics over time'. – (https://www.ons.gov.uk/methodology/geography). Further work in this area would be extremely useful
- Traffic Regulation Order data: In the absence of available, digital, standardised legal definitions of speed, parking and other restriction, the market is collecting data from sensing street signage. This will increase challenges in terms of legal definition where this differs from the signage – particularly in respect to automated vehicles. The DFT are leading on work to collect standardised TRO data from local authorities. Support to this

initiative would be welcome.

- Public Rights of Way data: The legal definition of PROWs is defined in the paper 1:10,000 scale Definitive Map and Statement, held locally at each local authority. A centrally collated, standardised digital legal definition would open this information and support wider tourism and rural economy policies.
- Planning and building control data (including Building construction types): This data is not available at a nationally consistent level beyond sign posting through the Planning Portal. There are significant commercial applications for this data and a nation resource of this data would aid central government housing statistics.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

While we fully support initiatives to increase usage of the UPRN and USRN and are in direct discussions with the Commission on the best way of making these available, we are not clear on the specification on the release of UPRN data (i.e. how sub-divisions, complex sites etc will be handled). We would suggest that there is a need for address data to be included with the UPRN and Co-ord for it to be useful.

We also have concerns on the specification for USRN data and associated geometry relating streets. Linking USRNs to OS Open Road will not provide a full set of USRNs and there will be ambiguity where matches are not on a one to one basis. We are working closely with OS to agree the most appropriate geometry for streets to be associated with open USRNs.

We consider the need to bring the management of postal addresses and official address created my local authorities closer in alignment to reduce duplication of effort in data matching and inconsistencies between to the PAF and the NAG
We consider a mandate for the use of the UPRN and USRN in public sector and citizen / business transactions with government around addresses and streets to be vital to ensure efficiency

Address and street validation services should be made available to ensure the correct address/street is located for these transactions. This has been successfully implemented as part of the online Electoral Registration service.

Address and street data for SMEs and private use provided as a transaction or low usage data provision with funding from Government would allow transactions to take place between public and private sectors more freely and to deliver innovation in geospatial services

We consider the availability of real-time data to users would improve overall

efficiency and ensure that services can be provided to new homes effectively.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No comments

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Focus on API technologies and validation services is key for the exploitation of geospatial data. Furthermore, the provision of hosted index services (for addresses and streets) would reduce the significant cost of managing local database updates to the market

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

There are several key areas where we see geospatial information supporting future technologies:

- Broadband
- Smart cities
- Driverless cars
- Smart Roads
- Electronic voting
- Non-fossil fuelled vehicles
- Machine Learning / AI

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Standardisation and data governance are key. Local authorities are the primary source of geospatial information and funding support to councils for address data maintenance would ensure that data is maintained to quality standards.

Government funding for access to address and street data with URPNs and USRNs (including the attribute data)

Mandate for UPRN and USRN use in the public sector

Joining up the address lifecycle process between the various public sector stakeholders

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No Comments

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Public Sector should be responsible for maintaining and making available core index data (addresses and streets, boundaries etc), private sector to develop services based on this.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Mandate addressing and street standards.

Better coordination knowledge sharing and prioritisation of effort in the use of address and street data across government to avoid duplication of effort (e.g. ONS, HMRC, NHS, DWP, GeoPlace, OS all have address data services). If these were pooled together and investment(s) focused much more could be achieved.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Deeper understanding of current and future market demands
Connecting / promoting geospatial data across government and into commercial sector

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

See response to Q4

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No comments

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

We suggest working closely with the LGA, GeoPlace, SOCITM, the AGI and others to demonstrate benefits and use cases.

GeoPlace already provides a hub for the co-ordination or work and sharing of best practices. We have achieved this by developing an officer network supported by regional and national events, online resources and working with partner organisations to highlight benefits to wider audiences.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Focus government departments to one location for address and street data (see previous comment on ONS, HMRC, NHS, DWP all developing address matching and verify tools alongside SMEs and GeoPlace / OS / LAs)

Q18: Are there any other areas that we should look at as a priority?

We consider the banking and finance markets to considerably benefit from access to address data – particularly in respect to address validation and reduction in fraud. Further market analysis in this area would be useful

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- Utility market reforms
- Digitisation of the planning system
- Connected and Autonomous Vehicles
- Home delivery

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Government funding to assist in promoting expertise internationally

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Denmark –open address and property life cycle management (Danish Geodata Agency) Australia – open addresses – PSMA Australia
Scottish Local Government Improvement Service's Spatial Hub

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	GeoSLAM
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

When we talk about geospatial data, it's an all-encompassing term – data where a position is relevant.

The data types seem complex, even to people who've worked in the industry for many years.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

GeoSLAM is of the view that there is a strong imperative to increase the national skillset in automated data analytics to extract value from mass data collection. The rationale for this is as follows:

- Global industry growth – the UK must remain a leader
- Impact for the country in terms of economic growth if we use of geospatial data better for example spurring on of smart liveable cities that people want to live and work in; and
- There is a current lack of qualified surveyors in the UK who are capable of

assessing and drawing value from geospatial data. The collection of geospatial data is no longer a surveyor specific skill, it can be done rapidly, quickly and automatically.

Our initial recommendation is that the UK should focus on:

- A geospatial data strategy that is 'digital first' mentality, ensuring degree and HE courses are teaching up to date data capture, processing and visualisation techniques;
- That a holistic view of data layering for optimised decision-making outcomes be introduced to new and diverse sectors;
- Include geospatial elements in degree and HE courses (IT, programming, STEM etc)
- Build real-life case studies of outcomes where geospatial data insight has resulted in a better outcome; and
- Begin to articulate and demonstrate how augmented reality presents an opportunity to clearly capture and display the value of geospatial data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As the nation continues its strategy of promoting STEM careers, the geospatial industry should be promoted along with the very practical career paths it can deliver to attract a greater volume of diverse people to join the industry from a younger age;

Investment in the automation of both the acquisition and extraction of data would help to alleviate the skills shortage but requires investment in adjacent areas such as machine learning.

Promotion of the the wide-ranging applications Geospatial data is relevant to, showing how Geospatial data can enhance analysis and lead to better outcomes – economically, socially and environmentally.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Data is held in silos across the public and private sectors, to develop a national digital twin, we need to provide open access to this data via a centralise storage repository, where data can be combined, shared and accessed
- The UK is lacking in indoor data, despite over 90% of our time being spent indoors, and clear social and economic benefits to improving and understanding where we live, work and socialise. Singapore should be looked at as a global leader, and the economic growth they are seeking to achieve through their digital twin project.
- Geospatial data becomes out of date quickly, how old data is archived, replaced and updated is an important consideration. The comparison of older Vs new data could be used to monitor changes in our built environment

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We'd need to see an increase in spatial resolution and a greater volume of data to enable greater outputs.

An overarching display methodology to organise and present a user-friendly way of viewing the data should be considered, see https://what3words.com/ as an example.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Aim to provide access to EO data at the highest temporal resolution possible.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Indoor localisation and mapping, given we spend >90% of our time indoors. If the goal is to develop a national digital twin, a large proportion of the required data will be indoors. The fast, efficient acquisition, processing and visualisation of indoor spaces will be critical in providing good quality, comprehensive data.

Critically, an infrastructure to access, utilise and make decisions on the data easily and as quickly as possible would be instrumental in the longevity of the exercise, using mobile apps, virtual reality, augmented reality, artificial intelligence.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Aside from driverless cars and robotics, we see there being significant advances in:

- UAV's
- Smart cities
- Improved infrastructure planning and modelling
- More efficient transportation networks
- Public service offerings

Geospatial data, when combined and layered with other data sets has the ability to generally optimise our everyday lives in a multitude of ways. The scope and potential the applied use of Geospatial data offers is expansive.

Q9: What are the options for how public sector organisations could continue tour invest in maintaining and enhancing our geospatial data assets?

Our recommendation is that public sector organisations should invest in the following:

- Improved development and access to 3D datasets
- More regular updates
- Data standardisation and compatibility
- Data hierarchy (trust level, especially if crowd sourced)
- Data security- what level of data should be made public & possible consequences for data being used unethically

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Open platform on which to store and access the data, following on from open data strategies such as open banking which has fuelled the UK's FinTech growth.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The Private sector should be encouraged and incentivised to both collect and make available geospatial data to the Public sector. Areas of priority around the Governments targets – economic growth and productivity e.g. underground, cities and transport could be incentivised more than less important areas to map. Our recommendation would be that a review of possible incentives is undertaken.

Proactive data collaboration rather than reactive data collection is key to using geospatial data to the best effect.

The Private sector can deliver the technology solutions needed to develop and maintain a world leading digital twin if funding and investment in research is provided.

A pilot study, combining public and private data collection, processing and visualisation would be a practical starting point for exploring the potential geospatial partnerships between the private and public sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Geospatial data is constantly changing and solutions that deliver a rapid mapping of environments on a frequent basis will be fundamental to keeping an up to date centralised database.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The view of GeoSLAM is that the Geospatial Commission would act as a coordinator across multi-disciplinary services, including local and central government, health and emergency services and security.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There would be significant benefit in mapping public buildings, areas of dense population e.g. sporting and event grounds and local authority housing (tower blocks and housing association assets). A centralised plan of these buildings and their surrounding should be a primary asset when planning, carrying our risk assessments and in the event of an emergency situation, the data should be rapidly available to improve outcomes.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Our belief is that a single UK strategy would be appropriate, given the need to centralise geospatial assets within a storage repository across the public and private sector.

The single strategy should consider the minimum standards of data quality and universal file formats for effective sharing and collaboration.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Location data coordination would be made more effective for local authorities by giving them rapid access to a centralised storage of geospatial data. This would have multiple uses and would be called upon in the event of emergency services needing to respond to, or plan for a public safety situation.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Continuous mapping for Infrastructure and construction – not simply initial geospatial data for design but regular focused updates through the construction and operation of infrastructure to achieve reduced capex of build (BIM level 2), reduced operating costs (BIM level 3), and reduced environmental impact.

Q18: Are there any other areas that we should look at as a priority?

Asset and facilities management through improved and more regular localisation of assets both indoors and outdoors. When added with IOT and AI operating costs of national infrastructure can be dramatically reduced.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

With economic growth through productivity gains having largely stalled in recent years, Governments globally are looking to AI driven industries to create new industries and transform existing areas of national strength. To prosper in a data driven economy, access to vast data sets is required.

Through the creation of virtualised geospatial related data sets, the UK has a once in a generation opportunity to transform its strong surveying industry and other sectors that require geospatial data into world leading technology driven sectors, where the analytics out perform due to the quantity of data that the analytics can be performed on, and where automation can be achieved more

readily.

Socially, mass geospatial data sets can fundamentally transform city design, including through public transport design, social housing, education facility location and many more.

The provision of virtualised data sets and data as a service presents challenges around both security and privacy of data which must be considered however with the significant steps forward in recent years around cryptographic engineering and distributed machine learning means that previously insurmountable challenges can now be reconsidered.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK can lead the way Globally in demonstrating the value and ROI of a national policy through key pilot projects.

Augmented reality offers a high-profile way to promote and show the value in geospatial data. Private organisations are already making significant progress into commercialising this data for everyday consumer and business use.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The best examples we have seen would be:

- Singapore smart cities
- Helsinki digital city

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

GeoSpock® | Uncharted discoveries

Call For Evidence Response

GeoSpock Ltd.

GeoSpock® | Uncharted discoveries

About you and your organisation:

Name	[Text redacted]
Organisation	**GeoSpock Ltd.** GeoSpock® provides analytics, builds insight and enables prediction across space and time. Our proprietary data integration platform visualises extreme amounts of contextual data in milliseconds. Its architecture has the ability to analyse trillions of geospatial and temporal data points in sub-second response time with its high performance, cloud-based services infin8™, illumin8™, and extrapol8™ https://geospock.com/
Job Title	[Text redacted]
Address	[Text redacted]
Email	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Mark with an X**
Academic	
Business representative/trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	

Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	X
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

The Geospatial Commission has identified three high-level themes that could help their approach to set a strategy which are as follows:

1. Supporting innovation in the geospatial sector, exploring how to secure cutting-edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. Enhancing the UK's geospatial assets, looking at how best to align interests, avoid duplication, and instil best practice across the whole public sector
3. Driving investment and productivity in geospatial applications, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our Questions

Q1. Is our view of the geospatial data types accurate, if not what should be included or excluded from this?

Type 1 (geospatial data) and type 2 (positional data) seem to merge two different concepts: whether the entity is fixed in space and whether place is a key feature of the data. These two concepts are not necessarily related and probably the former is more relevant.

Type 3 (geospatial identifiers) would probably need to also include relationships between those identifiers, which tend to have hierarchical structure.

Geospatial services may not be considered a data type. Indeed, higher-level processed data can be considered particular cases of types 1 and 2.

We therefore believe that having 3 categories makes sense: 1 - Fixed entity, 2 - Movable entity and 3 - Geospatial identifiers.

Q2. In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

The skills possessed by data scientists and data analysts will be key to making the most of expanding geospatial data sets. We also see these skills as essential to developing AI and machine learning capabilities to more efficiently recognise patterns within data, accelerate insights and increase the accuracy of predictions.

Data science teams, based within each Government department and coordinating the collection and sharing of data-sets could help optimise citizen services and reduce costs. It may also be necessary to upskill officers within Local Authorities, to ensure they benefit from the expanding geospatial evidence base, and could include - Planning officers (or GIS technicians - who will need to be able to process more complex data sets), Planning policy makers, City Deal and Enterprise Zone teams, local authority estates teams, environmental services teams etc.

Consultation with these teams will also be key to advising where data should be collected and what level of detail should be collected (as new technology makes it possible to process large data-sets), with regards to distributing more sensors within the built environment.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

At GeoSpock we have a growing team of around 45 employees. Our primary focus when recruiting is an exceptional standard in general software engineering skills. It is rare for candidates who meet our high software engineering standards to have much experience at all in any traditional GIS considerations, be that spatial indexing, projections, or an appreciation for considerations that need to be made when performing geometric calculations on the surface of the Earth (even under a simplified spherical model).

We would therefore value more candidates with a little basic GIS knowledge - we don't place a great deal of emphasis on deeper geospatial expertise - but our recruitment would be best addressed with a combination of some GIS with a high level of more general software engineering skills.

General awareness of location-based engineering and data analysis will increase as more case studies are published and ‘smart’ initiatives are implemented for the general public.

Q4. Are there any public or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

To demonstrate our product and value to customers, we have been combing through large, open data sets from the UK to identify those with a geospatial and/ or geotemporal element.

We have then ingested suitable geospatial data sets into our indexing machine (infin8), enabling us to display the data using our visualisation tool (illumin8) and query the data using our data analytics engine (extrapol8). This demonstrates our value to potential customers by showcasing how our product works with real-life data examples.

We have come across a number of particular challenges along the way - there are several government datasets with geospatial identifiers that would enable users to map different public and private datasets. Instead of offering these datasets through a open

government license, these datasets require costly licenses, posing a significant barrier for innovation.

Some of these datasets are:

- Ordnance Survey Code-Point with polygons
- National Address Gazetteer
- Parts of Ordnance survey mastermap

Another key dataset that is available through license is the property details dataset from the Valuation office Agency. Providing general characteristics about properties (size, number of rooms,...) would enable better analysis for the housing sector. Similarly HM Land Registry INSPIRE Index Polygons are available for free, but under a draconian license.

We have carried out some modelling using the DEFRA AURN air quality data. This dataset in principle covers a large number of years and pollutant measures across a comprehensive range of UK sites. However, in practise, the times over which each site/sensor is online vary considerably. It would be of considerable value if some of the gaps could be filled in.

Similarly, the Highways England traffic count dataset has traffic counts for major UK roads, however there is considerable non-overlap of times at which count sensors are recording. While considerable analysis can be performed using aggregated measures, for the purpose of traffic flow analysis (eg. computing the flow in/out of a city), the potential value of this dataset would be significantly increased if there were fewer gaps in the dataset.

Q5. Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

No comment.

Q6. How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

No comment.

Q7. Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The primary focus of digital innovation to date has been focused towards the creation of virtual applications and services which operate in cyberspace, and the relevant communication channels with which users can gain access to them.

However, the biggest area of future growth and innovation are those services and applications which operate in physical space. These services and applications target economic efficiency, health, energy and citizen lifestyle improvements across multiple sectors and impact all aspects of our lives.

Q8. How can geospatial data and applications be used to support the enhanced roll-out of future technologies?

Geospatial data is the critical component which allows these new services to take maximum advantage of contextual relevance which in turn allows them to have a fundamental impact on how their users interact with the physical world.

Future technologies including Smart Cities, Smart Mobility, Smart Energy and Smart Healthcare will all require integrated intelligence, of which geospatial contextual data is the most important and is a critical precursor to any AI system that hopes to operate in a physical service.

Q9. What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The UK has, without a doubt, one of the richest and most sophisticated processes of creating and maintaining geographical data assets - a world-leading public sector expertise that stretches back centuries.

However, future applications, especially those employing automated systems, requires the rapid evolution from geographic information to geospatial intelligence.

The latter, geospatial intelligence, requires a billion-times larger data sizes - from Gigabytes to Exabytes, and sample rates from years down to seconds.

Whilst public sector expertise is heavily geared towards surveying, mapping and maintaining - future applications necessitate the additional **real-time contextual intelligence** that only automated sensors can provide. The expertise on how to create these new type of data processing systems resides within a very small niche of deep-technology startups, which are driving innovation in the space.

Public sector organisations, by working with innovative SMEs, have the ability to quickly enhance their impact and bring multi-sector efficiency gains. Utilising public sector delivery expertise alongside the latest technology innovations would allow the unlocking of core geospatial data assets - using it as a bedrock with which to create a UK-wide innovation platform - driving future innovation, applications & services, and with it substantially increased economic output.

The challenge of the Public Sector engaging with startups is the relative speeds with which they move at - move too slowly and the startup will either go out of business before a purchase can be made or they will de-prioritise public impact in favour of private sector, which could lead to them be acquired by a large foreign technology company before the UK public sector can benefit from any homegrown innovation.

One solution model that has worked well in the market is that of Singapore, which has accessible budgets and rapid decision making for short-term pilot projects (which then lead to long-term engagements) specifically set aside for SMEs. Answers are given in weeks and project bandwidth is quickly allocated from the various in-house government technology teams, who then assemble complete solutions, sourced in-part from multiple company offerings, to solve critical public sector problems.

Q10. What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

No comment.

Q11. What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As a deep-tech startup, born out of academic research at a PhD level, GeoSpock aims to continue innovating in the spatial big data field, to disrupt existing markets for the better. We believe our role (alongside others in the private sector) should be to:

- Drive innovation - and be encouraged to do so
- Provide good value for money - with cost-effective tools and platforms
- Adhere to emerging data protection protocols, with solutions designed into the architecture from the beginning
- Open up access to data-sets (especially if these are funded by the taxpayer)
- Continue to collaborate with academic partners and industrial clients to develop further innovative and commercial solutions

Q12. Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

One of the biggest challenges when working with geospatial data from across the public sector is the large number of different identifiers used. For each identifier, the user needs to navigate the web to find the corresponding mapping in a version that matches the date for the input data. It would be desirable to have a central service that, given an identifier and version, would provide the correct mapping data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We welcome the creation of the Geospatial Commision and the recognition of the value of geospatial driven information and technology. GeoSpock are very keen to work with the Geospatial Commision and public sector - we are already positioned on the G-Cloud Framework and are in the process of proposing a number of 'smart city' projects in collaboration with Local Authorities (Cambridgeshire, Oxfordshire, Liverpool, Milton Keynes and Port Talbot among others).

We believe the Geospatial Commission can act as a more effective customer for our services (on behalf of the public sector) by -

- Setting out a clear framework for investment in and procurement of geospatial services.
- Providing the right ecosystem for niche deep tech start-ups and companies to grow, innovate and commercialise, as we point out in our answer to Q9.

In parallel to our work in the UK, we are also collaborating with a number of Singapore Government departments and agencies, as part of the Smart Nation initiative.

The Singapore Government are creating an unprecedented ecosystem for Geospatial businesses, such as ours, to deliver projects (by providing the necessary funding, people, education and cross-sector opportunities).

We welcome the following examples highlighted in the Singapore Geospatial Master Plan, for fostering a more effective relationship between business and government -

- Promoting an active data sharing landscape:
    - ISO standardisation of fundamental geospatial datasets across key domains.
    - Data Request Mechanism to make available datasets in the government
    - “Geotag by Default” policy to mandate the collection of location attributes for government datasets.
- Promoting inter-agency coordination:
    - Robust institutional structures for implementation to be well-defined among key stakeholder agencies, to facilitate extensive discourse and collaboration for building an active data-sharing landscape.

Q14. Are there any additional geospatial datasets, from the other Partner Bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Having a good understanding of where people are at different times of the day and the path and means of transport that they use when they travel can help city councils provide a better allocation of resources and define a data-driven transportation strategy.

Telecom companies already capture data that can be used for this purpose and this data can be aggregated and anonymized to protect privacy rights. Similarly, transportation

companies providing public services should make available vehicle tracking and performance data.

Particularly considering the shift to electric vehicles and away from hydrocarbon-fuelled vehicles, energy supply and distribution strategy is increasing in pertinence. If sufficient resolution data were available regarding energy usage (both spatial and temporal, perhaps available from National Grid/similar) were available, there could be a valuable use case around energy demand prediction, planning, and resilience in the context of building a 'Smart Nation'.

Another potential use case spanning the fields of health and transport, is the modelling of virus/disease spread. If detailed epidemiological data were available, the prediction of disease spread based on expected population behaviour could give emergency services important insights for load-planning, as well as the ability to advise the public in specified areas to, for example, work at home, on particular days. As a use-case, this would share many similarities with air pollutant prediction.

Q15. How can we best ensure effective local authority coordination and sharing of best practice, using location data to better deliver public services?

GeoSpock are currently in talks with a number of Local Authorities interested in using our services, however the projects they are proposing to tender for are very similar in nature, and we feel the local authorities could benefit on pooling resources and expertise, to save time and money.

We provide a data platform capable of handling and processing data at a nationwide scale. We believe this will enable local authorities to look in detail at not only their own data but also data across administrative boundaries. We are in the process of developing benchmarking tools can help Local Authorities compare and learn from each other, which can in turn motivate them to work together to find better solutions.

Being able to combine different geospatial data sets and look at data from both a national scale down to the granular street level can enable more accurate predictions and evidence-based decision making, resulting in better outcomes for local authorities and their citizens.

Q16. As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:
• property and land
• infrastructure and construction
• mobility
• natural resources
• sales and marketing

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

GeoSpock's location intelligence platform is very well placed to handle the future scales of data and geospatial events being generated by the high-value categories mentioned above. There are significant opportunities highly innovative new applications and services that share common themes:

- Data scales massively increased provide greater robustness and accuracy, for instance, for applications powered by machine learning
- Bring disparate datasets together to unlock significant value by running deep analytics at both a holistic and granular basis, for instance, to understand impact of pollution on education or healthcare, on a national (or even global) scale...or down to a bus route, bin lorry or car park
- Inform and influence consumer behaviour by managing massive data in a highly nimble fashion, for instance, real-time 'nudge' messaging, smart street signs and adaptive road systems
- Packaged location intelligence that is easily shared (and monetised)
- Accelerated outcomes by moving quicker whilst increasing the breadth and depth (and quality) of data captured from IoT sensors

Q17. Are there any other areas that we should look at as a priority?

We would welcome climate change monitoring to be included as a key priority. Using geospatial data to predict extreme weather events, encourage a move to renewable energy generation, monitoring CO2 emissions and optimising policy for a low carbon future are all important aspects, which in part rely on geospatial information and technology.

Q18. What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

Public sector innovations:

- Centralised mapping platforms - allowing local authorities to bring together historic and legacy data sets, with emerging data sets
- Digital twins - models of the built environment to help town planning, transport planning, logistics planning, improve efficiency and productivity of services
- More accurate air quality monitoring and predictions, with more localised sensors being provided as prices decrease
- Traffic Management Systems - which link together a number of different sensor point, and look at historical data

Private sector innovations:

- Vehicle to everything technologies (V2X) - which will reply on the processing of extreme amounts of geospatial data
- Internet of Things applications - which will see an explosions in contextual data as more devices and sensors become connected
- BIM
- Crime mapping - predictive policing tools

Many of these innovations, looking at how people move and behave geographically, would benefit from access to telco data, which can track movement through smart phones.

Data collection will also require very good connectivity - we would welcome the Commision facilitate the push to adopt 5G connectivity across the UK.

Q19. How best can we make the UK's presence in the international geospatial world more visible?

Opening up access to Ordnance Survey data would be beneficial. Many other countries already provide similar services for free, allowing developers to focus on experimenting and building applications on top.

We welcome your continuing work with the BSI and Future Cities Catapult to develop international standards for geospatial data structures and believe the UK are in a good position to deliver this.

Q20. Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? Which best practices are being modelled overseas that we can learn from?

We would welcome collaboration and learning from Singapore - the GeoWorks initiative is particularly relevant https://geoworks.sg/#aboutus

Helsinki has an advanced mobility services and would be an excellent case study.

Sweden is currently building a 'smart nation' team where a single person is in charge of coordinating all smart city activities across the country to ensure continuity and shared learning. The UK could learn from this and apply a similar structure.

Contact us

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	GeoXphere Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

They seem fine, but I have not considered them in detail. Regarding 'avoiding duplication', this is often aligned to innovation as competing companies push each other to improve and create better products/services. So duplication should not necessarily be seen as an issue.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission shouldn't focus on a specific area as that will warp the rest of the sector. Geospatial as a whole should be promoted through educational institutions.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is no shortage of geospatial skills in GeoXphere (but we are a tiny company).

But please see my general comments (delivered separately). Careers in the Geospatial Sector can best be promoted by reducing the scope of the Partner Bodies, eliminating their anti-competitive practices and establishing an effective dispute resolution procedure

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

MasterMap and Address data is too expensive for many commercial applications and it would be a great help if these were made freely available as Open Data. To be clear, this should be fully open, not free but within an API or hosted service by one provider.

The quality of many of the data.gov.uk PSI datasets are poor and inconsistent, and this makes them difficult to use. Public Rights of Way is a good example of this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes, I think that free and open access to UK address data would provide a significant boost to private sector products and services.

Addressing is a Natural Government Monopoly and forms the basis of many potential appliocations. If it's not made freely available then most of these applications will not be developed.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

In general I think the commission should avoid skewing the market by looking to promote Satellite-based EO applications 'artificially'.

Private-sector companies are already able to evaluate and use satellite-based EO in applications where the data is cost-effective and suitable for a given application. Investing in activities which try to promote satellite-based EO over other forms of EO (eg aerial photography, drones etc) is unlikely to help.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I am in favour of a very laissez-faire approach from government. I don't think it's the commission's business to focus on technologies because if they do so they are second-guessing the market.

However it is legitimate for the commission (acting as the government's 'expert customer') to run competitions to provide specific government agencies with products and services which they need.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Again, I think the government can help the most by standing back and letting the private sector develop products and services to address future technology requirements.

However, perhaps the Geospatial Commission could provide seed-corn funding to help the private sector to develop and trial new products and services. But this funding should be a) easy to access and b) based on ideas from the private sector and not vice-versa. This would be a much more cost-effective approach and would show the government to be actively supporting innovative ideas.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

I think it is **vital** that the public sector invests in the smallest possible set of national geospatial data assets, which should be rigorously defined. This would allow the private sector to invest in enhancements (both data and services related to the data) with confidence.

At the moment the private sector (and in particular SMEs with small resources) are fearful of investing in data or products which (if successful) are likely to become targets for unfair competition from dominant government agencies.

I can think of several datasets and services which GeoXphere and other SMEs would invest in if not for the fear of unfair competition from OS.

In summary the government should seek to maximise the scope for private sector competition to drive excellence, and minimise the areas where data (and adjacent data and services) are maintained by a government monopoly (and what amounts to unfair competition in the adjacent data and services).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

I think the public sector should maintain the geodetic framework for the UK's spatial infrastructure as well as a set of GPS differential stations to provide easy-to-use accurate positioning.

But I think the government should withdraw from providing any infrastructure to serve its data (as this creates a barrier to entry for the private sector).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should drive the development of new UK datesets and underpinning infrastructure, and I think the private sector would do an excellent job if it did not fear interference from the public sector.

[Text redacted]

GeoXphere would be very interested in investing in further national datasets and underpinning infrastructure, but not while there is a significant threat that OS will compete, which we think they probably would.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The UK has varying approaches to open data from different public sector organisations. Some choose to publish via Shapefile, some via WMS, and metadata relating to update schedules can be patchy at best.

Some data is found via data.gov.uk, some via other dedicated websites. This makes it challenging when using this data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission should;

a) create an environment which encourages private sector competition (by defining the minimum public task of the Partner Bodies and ensuring that they have no remit to act outside their Public Task),

b) provide a quick and robust complaints procedure which will protect private sector companies (in particular SMEs) from Partner Bodies acting outside their remit,

c) ensure that the Partner Bodies procure support from the Private Sector in an un-biassed way. [Text redacted]

d) Ensure that the role of government is minimised to leave the maximum scope for the private sector to build a strong Geospatial Industry. The fear that this would only encourage the Googles of the world to take over is in our opinion exaggerated. Google needs to concentrate of providing global solutions, so we think there is plenty of scope for the private sector to build smaller 'specialist' services which could grow into global products from a secure home base.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

I don't know. However, historically Intermaps NEXTMap Britain SAR-based height data was a good example of such a dataset. But as soon as Intermap offered it to the UK Public Sector, OS embarked on an upgrade to its own height data to destroy the opportunity. Intermap subsequently went out of business.

This expansionist policy does not encourage data owners to try to work with the UK government, or to build UK datasets in the first place.

If the threat of a government takeover of a new dataset was eliminated then GeoXphere would be interested in developing several new datasets (maybe in partnership with other private sector partners).

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

GeoXphere (and Getmapping before it) has invested over the last 10 years in developing a web-based infrastructure for use by all tiers of Local Government to share data and to establish common standards for aggregating data into open National Data layers.

Parish Online and District Online is in use by over 800 Local Councils and we have recently joined forces with Pear Technology and the National Association of Local Councils (NALC) to encourage the wider us of Parish Online and District Online across all tiers of Local Councils.

One of the key problems facing the smaller parish councils in particular is that they have insufficient resources to invest in creating and maintaining their own asset registers in a Digital Mapping System, which is an essential first step towards aggregating a national data layer. With NALCs help we are therefore starting a programme called Harnessing Local Knowledge. The aim of this programme is to persuade National Agencies to help fund Local Councils to collect data of national value – for instance the NHS could help to fund a National Defirillator dataset. We think that if each national agency could support Local Councils to collect the data that they need then this would fund Local Councils to adopt and use Digital Mapping systems effectively.

This programme would also ensure that Local Authorites adopted and promoted best practice, because, as a milti-tier system, Parish Online and District Online promote inter-tier and national best practice.

The Geospatial Commission can help by ensuring that some seed-corn funding is available (e.g. through the Local Digital Fund) and that these programmes encourage such private sector (though open) initiatives.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We think that industry is fully capable of expoiting opportunities in all these areas, and are constrained mainly by fear of competition from the Partner Bodies themselves.

By way of example I can report that when OS held workshops with its Partners to explore opportunities in these industries, it was a widely-held view amongst the Partners that it was best to say very little about any real opportunities for fear of competition from OS itself. This is a bad state of affairs which can only be resolved by an absolute separation of OS roles.

Q17: Are there any other areas that we should look at as a priority?

[Text redacted]

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Please see the description of Harnessing Local Knowledge in Q15.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

The UK's international presence can best be enhanced by encouraging the growth of a strong UK industry.This depends on;

a) Minimising the Public Tasks of the Partner Bodies,

b) Providing absolute separation between the Public Task and any commercial arm of the Public Bodies (but preferably the Public Bodies should have no commercial interests at all),

c) Providing a quick and effective Dispute Resolution procedure to protect the private sector.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

GeoXphere has an international presence and works closely with other private organisations around the world. While we may take a view that the UK has 'the best mapping in the world', the outside view is far from this. Our international partners feel sorry for us that we have monopolistic, government funded organisations within our industry that we have to work with and at the same time compete against.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Getmapping plc
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It would be good if we could introduce a common language set across the industry as none exists today. In IT for example, "services" is normally used to refer to the use of human or knowledge capital – e.g. training, consultancy etc and not as we might use it in geospatial for the streaming of data as a service.

Thus we would recommend using "geospatial services" to refer to insights, consultancy and training and "geospatial products" to refer to geospatial data or positional data (as you defined it) and any means of accessing the data (WMS etc).

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Firstly, we think there is a slight disconnect between theoretical teaching in schools and universities and practical applications of geospatial in the commercial world. It would be good to look at how we close this gap b y creating closer links between the commercial world and academia.

Secondly, there needs to be a strong focus on developing the skills we will need tomorrow as we embrace key changes such as the rise of the Internet of Things, the introduction of more solutions based on Artificial Intelligence and the use of Big Data and Cloud services.

Thirdly, it would be good to encourage more companies to follow the ESRI model and provide their data, services, software etc for free into schools.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Our main skills gap is our understanding of what are going to be the key drivers of change tomorrow. We are very switched on to what our users do today, but it is starting to change rapidly, and we need to be better aware of the key drivers of this change to help support creating solutions to the geospatial challenges that they will present.

We expect that the users of tomorrow will be more diverse and less geospatially aware than users today, so skills in consultancy (listening and challenging etc) combined with good technical geospatial knowledge will be of huge value.

Therefore, part of the development of the geospatial skill base needs to also focus on more mainstream “consultancy” skills as more and more we will be called on to engage with customers/partners/stakeholders to build end t end solutions rather than just to provide data.

Given that geospatial is now becoming a main stream activity supporting most of the new technological advances globally, we should not have a problem attracting young talent into the industry providing that we start to promote the exciting power and value of geospatial over the traditional view of “mapping and theodolites”.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There needs to be consultation with industry, but at a wider level of end users etc, not just the geospatial suppliers. If the key sectors are property and land, infrastructure and construction etc then these are the areas that should be consulted, with a strong focus on future technology enablers in addition to what is needed today.

We also think you should consider encouraging two levels of access:

- Public Sector “Free to use”: funded for the public sector to use freely to promote and stimulate growth. An example here might be utilities data or care home data which should be shared freely amongst institutions but not with the general public/commercial sector

- Open Data: Free to use for public and commercial users. This should be restricted to data that is genuinely going to stimulate growth and innovation and not just datasets that industry would like to have for free. Examples might include Mastermap Topo or aerial photography for smaller areas to support SME growth.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes! It is clear from talking to Local Authority users that there is intense frustration about the disconnect between Local Government, Geoplace, Addressbase and the Royal Mail. An immediate impact that the Geospatial Commission could have would be to take ownership of addressing in its broadest sense and create a flowline whereby data is standardised and then disseminated rapidly across this flowline to the benefit of all stakeholders. This would introduce significant efficiency savings for public sector bodies.

Locational data is going to becoming even more important with the rise of automated home deliveries, autonomous vehicles and smart senor deployment, so ensuring that our various addressing products are consistent and as up to date as possible is going to be critical.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

It is first worth going back a step and asking “should the Commission be looking to develop EO?” It needs an understanding of the current role and strategy of the UK Space Body and clear visibility of how the Commission could/would do it better. The Commission has a lot to do, so this may be one area that is worth leaving with its current owners for now. However, there should be close collaboration so that the Commission is ready to create access to EO data as and when there is a strong user demand for the data.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The obvious big drivers are the internet of things (i.e. smart sensors), artificial intelligence (particularly autonomous vehicles, but also machine learning) and the use of big data analytics to identify previously unseen patterns and trends in data (both geospatial and demographic). All of this will also require a strong wireless backbone – 5G.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

It is difficult to answer this as what is needed is further research into the needs of these technologies to help drive the strategy for geospatial development. Almost certainly it will need more real-time data or more frequent updates, more detailed and accurate data and fully three-dimensional data for some or all of these technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

If we are serious about the importance of geospatial data to future economic growth, as we should be, then it is vital that we provide adequate resources to the Public Sector to maintain key geospatial datasets. The Public Sector is under immense strain with major resourcing shortages, so in essence it needs funds. This funding could come from a number of sources/methods:

- Direct funding from Central Government, either as increased funding grants or by funding more core datasets centrally to reduce costs to the Public Sector so that they can invest more in data maintenance activities
- The predicted £11bn of economic value should generate government revenues of >£1bn in taxes; some of this revenue should cascade down to the Public Sector to support the continued maintenance of the datasets that are generating this value
- Public/Private Partnerships to collect data that is provided free (or at cost) for the Public Sector through the revenue generated from the commercial exploitation of the data (e.g. Aerial Photography, LiDAR data, traffic information, retail data etc.)

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The Smartnet system run by the OS and Leica is a great example of how accurate positioning can be achieved at the click of a button with a wireless signal. Further work to look at opening this up as a free to use system would support much of the technological developments discussed above, especially when combined with the advent of 5G and better coverage.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector brings some key skills to the geospatial picture which should not be ignored. These include commercial acumen, deep knowledge of technical capabilities and customer requirements, creativity and the ability to deliver agile innovation, and a strong empathy with the end user experience. However, it would be dangerous to allow the private sector to fully control aspects of the geospatial framework or key data assets interpedently as there could be strong tensions between the strategic need and the drive for commercial gain. They are not always comfortable bed fellows.

Therefore, a number of options should be considered:

a. Public/Private initiatives
b. Frame work agreements – long term but with cancellation clauses and/or the ability to retender periodically to ensure best value and a high quality of service is maintained

Given the current economic outlook in terms of what Brexit may bring, it is also a vital aspect of the Geospatial Commission's remit to support the UK geospatial industry, particularly SMEs. Ensuring they play a strong role in delivering the geospatial strategy is therefore a great way to deliver on two key objectives in one fell swoop.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Whilst we do not encounter specific problems ourselves, I have heard at first hand from many public sector bodies about the frustrations they face accessing public sector data themselves. This takes a number of forms:

a. Organisations acting in silos: often an organisation has data but does not share it; this is particularly prevalent within organisations where data in planning for example is not accessible to other departments; one example between organisations
b. Sharing data between organisations – for example there is huge frustration that Local Authorities do not get access to utility data
c. Commercial access to public sector data – whilst some data should not be shared publicly, most of the data that could be is difficult to access. A centralised data portal for this public sector data would be a valuable enabler to the whole geospatial sector

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

There are a number of ways in which the Geospatial Commission can add value to this process:

a. Setting common standards for data quality
b. Promoting better interoperability
c. Facilitating the sharing of best practice
d. Leveraging Group purchasing power to deliver better value to the Public Sector
e. Supporting, co-ordinating and engaging in a wider range of innovation projects at the cutting edge of geospatial to avoid effort being repeated across different areas of the Public Sector

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

In conversations with Public Sector Users, several themes recur. Firstly, access to utility mapping of underground assets would be hugely beneficial. It seems to make perfect sense that the Public Sector and the Utilities should be working from a common dataset of underground assets, and this is an area the Geospatial Commission could help develop.

Secondly, there are concerns around the status of addressing and related data and the disconnects that exist or may exist between Geoplace data, Addressbase and Royal Mail datasets. Again, a coordinated program to streamline and align the various datasets and their means of capture would be hugely beneficial.

Taking a more holistic view, it is often perceived that many public sector bodies operate in silos and that data is often not shared around an organisation effectively, let alone between organisations. There must be ways to open up this data (some of which is non-geospatial but becomes more valuable when combined with geospatial data) to all appropriate users across the public sector.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

I strongly feel that it starts with a Vision – perhaps ten years out – of where we want the UK geospatial sector to be in terms of:

- Public Sector capabilities
- Private Sector capabilities
- The key enablers that are in place to continue to lead in this area (e.g. access to open data, infrastructure support (6G, Smartnet etc) etc

This should be a UK-wide vision framework, within which regions can be given some scope to add regional variations relevant to their areas.

Once a clear vision has been created, we can then set some key milestones along the way – where we want to be in 8 years, 6, 4 and 2 for example. We need to work this way round as studies prove that starting with the end in mind creates much more ambitious targets than those created by extrapolating forwards from today (up to 1500% in some cases).

Then we can create clear plans for delivering the first two-year milestone, whilst maintaining a clear view of the general sense of direction and where we are trying to go.

This strategy is then reviewed regularly as no plan survives collision with reality intact, so provision must be made for changes that occur along the way (e.g. technological advances etc).

For this to work well, however, it will need buy in from all key stakeholders – Central Government as the sponsor, the rest of the Public Sector (as they will be key enablers of delivering the vision) and key parts of the Private Sector (who will also play a major role in delivering the vision). Without buy-in from these sectors, it will be hard to deliver the vision as road blocks will be thrown in its way at regular intervals.

However, in the early days it will be hard to get full alignment from all stakeholders, so there will have to be a journey from telling/selling the vision through involvement to full collaboration. This won't happen overnight, so the Geospatial Commission will need to be given the backing to make some key decisions itself in the early days (based on sound data collection of course).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The impression we get looking in to the Public Sector as a supplier/partner, and based on many conversations with people working in this sector, is that this is not an insurmountable problem, but it does require a shift in mindset.

Most organisations are working in self-constructed silos, and often information is not shared well within an organisation, let alone across them. A big factor in this is scarcity of resources – lack of time, lack of resources, lack of funding. It is hard for many public sector workers to get to events such as PSMA as they don't have the time or the budget to attend.

As a result, there is very little sharing of best practice and the engagement on forums and the knowledge base are the preserve of a few enthusiastic people, not the majority. However, we are always struck by the passion in our industry for what we do so we believe that the will is there.

One solution is to provide more resourcing specifically to facilitate knowledge sharing across the Public Sector. The creation of regional coordinators for example would help, but also the funding needs to be specifically provided directly to the Public Sector bodies to a. support a centrally driven initiative to capture best practice across the whole of the Public Sector and then b. to fund making the changes that are recommended by the program.

A second solution is to stimulate more innovation programs and public/private initiatives to look at ways of working more effectively for both what we do today and what we will need to do tomorrow.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

There are a broad range of current and potential applications that could be scaled up to capture more value. The key ones are likely to be:

- 3d base mapping (an essential shift from the current mostly 2d base mapping)
- Applications to support future transport needs (parking, autonomous vehicles, flying taxis etc)
- Applications to support BIM and the rise of visualisation/augmented reality in the construction sector
- Applications to support the deployment and management of smart sensors
- Applications in support of renewable energy

Q18: Are there any other areas that we should look at as a priority?

There are several areas where further effort would deliver significant benefits. However, these tend to straddle the above areas:

a. Embracing new technology – the Internet of Things: one of the most frequent requests we get is for newer data, more frequent repeat data and even real time data. The rise of the smart sensors needs to be embraced by the geospatial industry as a key capture source for more real time data – everything from retail footfall to changing commuting habits will be captured in some form by smart sensors, and geospatial data will provide the platform and foundation for using this data more intelligently. Initiatives such as BIM and the rise of the Autonomous Vehicle industry all present challenges and opportunities in our sector.
b. Moving from 2D to 3D: New applications, particularly in the automotive field, are making increasing demands for more detailed 3d data. The traditional 2d map will not be fit for purpose for autonomous vehicles, flying taxis etc. New technology and services will need x, y and Z. Therefore, we need to be working on the base maps of the future in 3D, not 2D or even 2.5D.
c. Preparing for changes in lifestyle: There is no doubt that IoT and AI (including autonomous vehicles) are going to have a huge impact on the way we live. For example, several studies suggest that we will start to commute further and longer if we don't have to drive ourselves – people will start to abandon urban living for more rural environments if they can spend the commute to work catching up on last nights TV, working or even sleeping!
d. Exporting what is good: I genuinely believe that UK plc can benefit massively from being a leader in the field of applying geospatial data to the changing world we live in.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

This question gets to the heart of why the geospatial commission is so important., because in the past geospatial was regarded as something of a niche industry, but today it is central to so many industries and applications. The traditional users of data such as the Public Sector and Construction will continue to need more and more detailed data, but we are also now seeing a wide range of new users of data across all sectors from finance and insurance to gaming and augmented reality, with everything in between. Key enablers such as the IoT, Artificial Intelligence and Big Data Analytics all massively overlap now into the geospatial space, so industry and government need to identify new ways of working and new support infrastructures for these developing technologies.

Two obvious key enablers are the Smart City program and the Autonomous Vehicles sector. Both will require a much higher level of detail in their base data, and a much more frequent refresh rate for most of the data they use.

There will be corresponding regulatory challenges – who owns and maintains the data on which our autonomous vehicles will depend for example and who owns the definitive mapping on which Smart services are built? The answer for me in both cases needs to be Government and not the private sector, but good PPI type initiatives may also hold the key to this as it will allow Government to effectively commercialise the offering (which the Private Sector has more experience of) whilst retaining strong regulatory control (which the public sector is vastly experienced in).

Q20: How best can we make the UK's presence in the international geospatial world more visible?

There are a number of ways to achieve this:

- Providing funding into innovation linked to the international commercialisation of good geospatial solutions (as opposed to purely domestic ones)
- Providing strong thought leadership on a global platform – sponsoring geospatial commissioners, key public sector experts, academia and leaders in the private sector to attend and speak at key international events – Intergeo, Hexagon Live, ASPRS etc in the geospatial space and key events in the major sectors outlined above - SMART City Week, Africa Mining Indaba, International Construction shows etc
- Diverting international aid into geospatial projects led by UK companies in developing nations (as announced by the Prime Minister recently)
- Creating an international geospatial innovation catapult hub to help start-ups and SME's to launch their geospatial products and services internationally

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There is probably no one single place to go for all of this, but there are beacons of exemplary practice in different areas across the globe. For example:

- North Carolina is very proactive in the autonomous vehicles space
- Singapore and Barcelona are recognised leaders in the SMART City space
- The Netherlands and Denmark are both mapped nationally on an annual basis (as are other countries) through a consortium of key public sector stakeholders
- The USA leads the world as the most geospatially-ready country, largely due to its national policy framework and regular high-resolution update programs

However, we should also look to emerging nations for inspiration as they will often have opportunities to implement new technology far more easily than we will. For example, Kenya was one of the first countries in the world to introduce payment by phone technology (Mpesa), largely because it had no mobile infrastructure and was therefore able to implement 3G technology as its first solution rather than work up to it through an upgrade program.

Thank you for your time in completing your response to our call for evidence.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Glasgow City Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The four definitions are satisfactory as described but the Commission may wish to consider references to temporal attributes associated with these four definitions. Geospatial data, particularly recently captured data, is likely to always have a temporal stamp which describes either its date/time of capture, date/time of expiry or associations with calendars or events. Such temporal information enhances significantly the value of the geospatial data over time in offering temporal and spatial insight.
Consequently, an additional definition of associated temporal data is worthy of consideration.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The Commission's desire to work with industry, academia and the public sector to develop geospatial capability is welcome. However, the geospatial practitioners who will likely add most value to future transformational and innovative opportunities will be those who understand the application of the science as well as the theory underpinning the technology and solutions. Historically, and justifiably, traditional geospatial skills have come from a geography and mapping perspective and geospatial skills revolved around presentation and visualisation. The mature sector now needs to move towards an analytical and value-added output such that geospatial becomes a core part of any project in the same way as financial controls and project management.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Geospatial is often seen to be “GIS”: that is too simplistic. To truly maximise the value of geospatial one needs a combination of GIS alongside e.g. data analytics, business analysts, design and graphic artists, data engineers, data scientists and senior managers. The historical specialist market of geospatial must be widened to embrace such multiple disciplines if geospatial is to both embrace and deliver all its potential.
It is suggested that the Commission be bold in promoting the appliance of geospatial so that benefits are seen across a wider audience and that geospatial becomes a foundational business process which informs and guides policy and strategy rather than one which, historically, has demonstrated outcomes.
Careers might be best demonstrated through telling the story of how geospatial is helping to develop new ways of working, how it transforms business processes, how it informs “silently”, in the background, as an essential element of service delivery. Users use geospatial but are generally unaware of that: raising awareness of this silent science will demonstrate the diversity and reach of geospatial which, in turn, should encourage more interest in the technology and its solutions.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The lack of a single unified national street gazetteer in Scotland is challenging. A unified and consistently attributed national street gazetteer (i.e. OS Highways with USRN’s) is required in Scotland.
In Scotland, consideration should be given to sharing registered land and property title boundaries from the Registers of Scotland with the public sector, so enabling an appropriate reconciliation between ownership, service delivery and operational management for land and buildings.
We believe that the national infrastructure datasets are of insufficient quality to be relied upon for asset management planning or for excavation works. A national initiative to improve these datasets will be required – there are too many competing demands at a local level to overcome this challenge.
The Commission may also wish to consider a national open geospatial data portal, accessible to public submission and comment, which might then be validated by an appropriate authority before formal adoption of the records. There is no better advocate for accurate data than the end user so why does UK not encourage “public” submissions (subject to validation) to its geospatial data portals? It has worked well for OpenStreetMap and it can work well for general geospatial data.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The current addressing solutions are generally fit-for-purpose and, importantly, robust and sustainable.
The Commission may wish to consider ways of shortening the end-to-end process of address management so that new or amended addresses are available for use in the public domain far quicker than is currently the case.
Public bodies, emergency services and utility companies typically enjoy early access to amended address information but the general public, retail websites, delivery companies, sat-nav providers and taxi organisations are not well served.
There is a gap in consideration of addressing at a granular level (see What3Words) land and assets which are not associated with a postal address.
Given future foresight, the Commission may wish to consider how granular an address might be and promote discussion on an appropriate and sustainable solution which will complement PAF and BS7666 going forwards.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No comment.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Artificial Intelligence – The Commission might want to explore the role that artificial intelligence (AI) can play for helping to derive insight from increasingly complex geospatial data (particularly where it is overlaid with temporal information, for example real-time information). Such insight might provide the development of real-time and/or predictive products and services

Distributed Ledger Technology – It would be remiss to provide examples of new technology and not refer to Blockchain. Rather than Blockchain per say, it is becoming increasingly recognised that Distributed Ledger technology provides new opportunities for transforming how transactions with the public sector are recorded.
The Government Office for Science's report "Distributed Ledger Technology: beyond block chain" (here) concludes that the use of Distributed Ledger Technology can (amongst other benefits) increase transparency and traceability of how aid money is spent and creating opportunities for economic growth, bolstering SMEs and increasing trust. Applications of the technology within the context of geospatial information might include smart contracts and land and property transactions.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The canvas for emerging and future technologies is increasingly becoming the built environment rather than the office (where its focus has typically been in the past). Technologies such as the Internet of Things (IoT) and Virtual Reality (VR)/Augmented Reality (AR) begin to bring our physical world and virtual world closer together. Glasgow has extensive experience of this through the Innovate UK Glasgow Future Cities Demonstrator and our subsequent smart city work. Geospatial data and applications can support cities like Glasgow to deliver rich innovative smart city solutions such as;

- Smart Energy and Environment
- Smart Transport and Mobility (including autonomous vehicles)
- Smart Tourism and Heritage
- Smart Health and Wellbeing (particularly for encouraging physical activity)
- Smart Learning and Teaching

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The Commission may consider the active promotion and adoption of open and shared data platforms to foster a wide scrutiny of that data and to encourage third party and public contributions to corrections and amendments to that data, subject to validation.
The Commission may also consider how it might encourage, or even legislate, for a “single-source-of-truth” culture which will both break down silo working and eliminate errors due to data currency issues.
In summary: public or third party contributions to data maintenance and shared data repositories across public services, subject to appropriate adherence to legislative requirements, will likely deliver improved data currency and a reduction in errors and omissions.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The underpinning infrastructure is changing at such a rapid pace that it is unlikely that any recommendations on infrastructure made now would be appropriate in two years' time. Consequently, the Commission may seek to promote a robust, unique and hierarchical spatial referencing system which could accommodate National Grid references, PAF references and non-addressable locations for external and internal assets and spaces such that any granular space or asset could be uniquely identified and positioned across the spatial extents of the UK. Such a unified and hierarchical referencing structure (distinct from existing data standards) would greatly enhance data-interoperability and the value of that data to the UK economy.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

There is a critical role for the private sector in this arena. The private and public sectors bring similarly innovative thinking to challenges and solutions whilst the private sector also brings an investment and risk-acceptance capability to development and improvement which is typically less restrained than the public sector mode of operation.
It is important to understand that the public sector are primarily service-delivery organisations whose primary focus should be on the delivery of high quality services which enable social improvement and economic development.
Conversely, the private sector has the financial freedom and approach to risk that enables innovation and infrastructure investment across a national arena.
Partnership is the key with both parties combining to enable high-quality service delivery underpinned with fit-for-purpose infrastructure and data management planning.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The single biggest challenge to sharing geospatial data across the public sector is the absence of national data standards which can be applied to multiple datasets. It is apparent that the requirements of BS7666 have enabled the national sharing and exchange of street and property gazetteer datasets but there are few other datasets so easily exchanged.
The Commission may wish to consider supporting the Scotland model of the Improvement Service acting as a portal for some public sector datasets as an exemplar of well-intentioned ambition with a realistic chance of successful delivery of a national and unified data portal.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

As in the Commission's Call for Evidence document, a fuller understanding of use-cases and value-added opportunities will inform the worth of geospatial data to the public sector.
Whilst the Commission seeks to be an effective customer it may wish to consider developing a matrix of cost-benefit, value-added and data expiry so that procured geospatial data may be measured for the benefits it may deliver in addition to the traditional view of cost to the customer.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comment.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

NOTE: The Call for Evidence describes "national" variations. The respondent has assumed this questionnaire is correct in asking about "regional" variations.
If there are any geospatial datasets that require regional variations then those regional variations should be accommodated through referenced secondary datasets, e.g. parent master and child subset for the regional variation. There is a significant risk to future data-interoperability if too many regional variations are permitted: rather, uniformity of structure and attribution should be the goal. If parent masters are unified then secondary children can be easily linked.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

National data standards will promote and encourage uniformity of data but there must also be a structure of standard governance around data and geospatial data. The Commission may wish to consider promoting positions in the role of e.g. Data Standards or Data Custodian officers at regional and governmental level to take responsibility for data best practice, open data and data interoperability.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Identifying urban sites for solar or wind farm location.
- Infrastructure investment planning in transport networks using condition indicators, passenger and journey numbers, fuel costs etc. A mobile workforce enhances economic value and potential.
- Opportunity and access to services for residents in deprived zones – encouraging improved health, fitness levels, eating habits, learning opportunities and access to voluntary or paid employment.

Q18: Are there any other areas that we should look at as a priority?

It is increasingly difficult to separate geospatial data and applications from broader data analytics and data applications. Whilst ensuring that the scope is clearly defined for geospatial data the commission might want to consider the increasing opportunity to:-

- Integrate geospatial data with temporal real-time information
- Provide richer representation of the built environment through Building Information Modelling (BIM) and 3D modelling
- Use Artificial Intelligence to provide richer insight into geospatial information

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Regulatory challenges are likely to arise around privacy and personal data issues. Wherever possible, these should be overcome so that the national economy and infrastructure can be enhanced and continuously improved.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The Commission may wish to consider the synergies between geospatial data and BIM, combining the two UK exemplar practices into a seamless data experience.

The Commission may wish to recognise that the EO mini-satellite industry is significant on a global stage in terms of growth potential and innovation in the geospatial field and so encourage its inclusion in the traditional geospatial arenas. The two are moving towards each other but more rapid movement is necessary.

The UK is already a world leader in geospatial use and innovation but the public are typically unaware of it. The Commission may consider promoting the breadth and depth of geospatial solutions to the general public to foster a greater awareness of geospatial solutions and a hunger for more geospatial innovation. The use of geospatial data and solutions is a sleeping giant which is about to explode on the world in the way the world wide web did some years ago. We, as practitioners, must be ready for both the growth in the geospatial services supplied and the demand for innovation.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Helsinki's 3-D City Model (here)
Netherlands infrastructure modelling (here)
The Official Website of the City of New York (here) and the MODA function (here)

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Greater London Authority
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The description covers the different types of data. One recommendation would be to more explicitly describe 'core linking datasets'. We suggest using the approach that was described in the National Information Infrastructure work.

The creation, maintenance and sharing of core geographies such as Census Output Areas revolutionised the ability to combine data from different sources, track change over time with confidence and innovate.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

One area where we have increased demand is in the overlap between data science and spatial skills (spatial data science). An action could be to offer a sound spatial grounding on data science courses and to improve the data science skills of GIS students and professionals.

At present, we have to fill this need through additional training, support and mentoring of staff after appointment.

The other area is mapping skills for web developers (such as JavaScript developers) who are leading the way in create public facing applications and tools for professional users.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is quite a large gap between the skills and experience of a recent graduate (or typically, post-graduate) and the Cgeog (GIS), with no clear professional route marking out stages between the two (in contrast to, for instance, Planning which has a well-structured career path).

A national framework would be helpful to map the path(s) from one to another for both employers and employees.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We are regularly asked to work on policy questions where floorspace information would be tremendously helpful, but we have not been able to access detailed Valuation Office Agency data. Recent examples include assessing the health of London High Streets (where we were looking to apportion values from ONS 'Workplace Zones', but only had land use available. Equally, we have been analysing the energy profiles of London's buildings and floorspace is a key factor along with different uses and their respective energy profiles.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We often notice a misalignment in postcode data between postcodes points (open), postcode points (psma), postcode polygons and the postcode listed in AddressBase Plus. This is mainly due to the timing of update cycles, but causes problems for analysis and confusion for our users.

Looking at AddressBase in particular, we are often interested in how a building is used, rather than simple presence/absence. Although a very detailed set of codes are available in the 'class' field, these are very inconsistently completed (to the extent that they are often just 'C' & 'R' for commercial and residential) rendering this field of very limited use for analysis purposes. There is clearly an overhead for local authorities entering this information and keeping it up to date that not all are able to meet.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We have begun exploring the use of satellite data for areas that are changing rapidly (such as the Olympic Park, which is undergoing large-scale redevelopment post games). Although not detailed enough in its own right (compared to Aerial Imagery), this can detect changes such as road alignment and new phases of building and prompt follow up work.

We are also looking at satellite data as an input to our air quality models (as it can show how background pollution travels from mainland Europe).

In both cases, better alignment with mainstream GIS conventions (such formats and projections) would lower the barrier to using this data (and maybe could be developed with the Satellite Catapult)?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

IoT clearly has the potential to revolutionise city data analytics. This will include smart lampposts / benches, connected Building Management Systems as part of smart energy grids, monitoring of Green Infrastructure and rapid turnaround of social and economic indicators.

Location standards for IoT data are needed to take full advantage of these new technologies.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Initiatives such as OS ZoomStack (and ZoomStack with MasterMap) coupled with new approaches to storage, delivery over the web and styling such as vector tiles have the potential to revolutionise how start-ups and innovators use base mapping in particular.

Where core enabling datasets are released there needs to be medium term commitment (say 10 years) to maintaining them, so that businesses can enhance them and build products with confidence.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

No response at present

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No response at present

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

No response at present

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Land Registry CCO data has been extremely useful, but suffers from inconsistent naming of owners in particular (for instance, there are over 10 spellings of Greater London Authority) making searches and filters very difficult.

Use of linking data (such as UPRN) is essential between the different datasets.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It has been a huge technical challenge and overhead for many years having to process the different OS products for the whole of London, including managing numerous update cycles and partial updates. Many other authorities experience similar problems. Innovations such as ZoomStack and the supply of data using standards such as PostGIS and GeoPackages should

a) Be continued after the trial
b) be applied to all products including Highways, etc.

The PSMA revolutionised the ability to share derived data between central government / local government and between local government organisations.

However, restrictions to sharing the data with the wider ecosystem remain and cause barriers to sharing, enhancing the data and innovation.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Detailed height data, including terrain and heights for complex multi-part buildings. E.g. access to support 5g rollout.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

N / A

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

A hierarchy of standards is needed so that it is clear where national standards stop and city standards should begin.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We are working to improve the flow of planning data, including making constraint layers available and digital data from applicant through local planning authority to GLA.

Mapping and sharing infrastructure data (including capacity analysis and future investment plans) has been estimated to create several £m of savings.

Support for the development of Green Infrastructure.

5G – requires detailed 3D sight-line analysis

Q18: Are there any other areas that we should look at as a priority?

See previous answers

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

None at present

Q20: How best can we make the UK's presence in the international geospatial world more visible?

There are networks of Cities emerging across Europe and also in the US that are sharing experiences about the use of data, the better defining of requirements and specifications. These could promote the work of the Geospatial Committee in UK cities directly to other cities.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

This is difficult to answer as many other cities have to map their own features such as roads, whereas we benefit from a national mapping agency.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Historic England
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Please note that Historic England is the Government's statutory adviser on all matters relating to the historic environment in England. We are a non-departmental public body established under the National Heritage Act 1983 and sponsored by the Department for Digital, Culture, Media and Sport (DCMS). We champion and protect England's historic places, providing expert advice to local planning authorities, developers, owners and communities, to help ensure our historic environment is properly understood, enjoyed and cared for.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial data underpins many of the activities undertaken by Historic England, English Heritage and the wider heritage sector by providing a measurable and quantifiable baseline against which other factors can be compared, investigated, analysed and reported upon. This ranges from mapping archaeological landscapes, unlocking new archaeological discoveries from aerial imaging and collating listing information down to recording and condition assessment of historic fabric so covers all types, scales and accuracies of geospatial data. It covers the understanding of place in order to understand and explain the heritage interest of a particular area and is often contained in a series of data layers that collectively define the importance and significance of a location. This appears to align well with the listed data types – geospatial data, positional data, geospatial identifiers and geospatial services – included in the strategy so in our opinion they are accurate and should all retained.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Apprenticeships - the strategy already highlights the exciting opportunities for upskilling the sector provided via the new Geospatial apprenticeships but only mentions the Geospatial Mapping and Science level 6 apprenticeship suggesting only degree level qualifications spread over five years are important to the Commission and Government. It should therefore include reference to the equally important Geospatial Survey Technician level 3 apprenticeship given they are typically two years duration and will attract new persons into a geospatial career, as has happened within Historic England with the recruitment of our first geospatial 'heritage' apprenticeship with the Geospatial Imaging team (see https://historicengland.org.uk/about/jobs/apprenticeships/ & https://historicengland.org.uk/services-skills/training-skills/work-based-training/heritage-apprenticeships/). Although interest in the IFA's scheme appears high it appears recruitment numbers are worryingly low which may be due to the standards only just being approved so the Commission may wish to better promote the benefits of both geospatial apprenticeships to attract more interest in recruiting from both private and public sectors. It also needs to assist with the formal 'off-site' training provided by external training providers given those that are currently offering such training are having to adapt their existing training programmes to incorporate the required modules that satisfy the new geospatial standards. Hopefully this will improve as more apprenticeships are recruited and custom geospatial training programmes are developed by the training providers such as Leeds College of Building and Dudley College of Technology.

Training in Geospatial technologies - there is increasing overlap in the technologies now being used for deriving geospatial data which is helping to democratise its capture across different disciplines that traditionally have not considered it or not had the skills to undertake it. For example the archaeology and architecture sectors are increasingly using modern 'Structure-from-Motion' photogrammetry given the relative ease and cost at which three dimensional data can now be derived compared to previous analogue and analytical approaches (see https://historicengland.org.uk/images-books/publications/photogrammetric-applications-for-cultural-heritage/). However to ensure an appropriate quality of data is derived that remains 'fit for purpose' the Commission may wish to consider supporting and possibly funding training opportunities that embrace modern geospatial technologies and promote their use across specialist and non-specialist areas (such as within https://historicengland.org.uk/services-skills/training-skills/heritage-practice-residential/measured-survey-summer-school/) in order to widen awareness of these approaches and the impact of the knowledge already contained within the UK's geospatial sector.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Historic England has its own Geospatial Imaging team in York which carries out metric surveys of historic objects, buildings, sites and landscapes using a variety of geospatial technology including laser scanning, photogrammetry and multi-image based 'Structure-from-Motion' survey approaches. It also provides the corporate lead on the heritage application of RPAS/UAV/drone platforms and Building Information Modelling (BIM) whilst also liaising with other teams across the organisation, such as Aerial Investigation and Mapping, Historic Places Investigation, Geophysics and Archaeology, on the use, application and archiving of other geospatially derived datasets. It therefore retains an acceptable level of geospatial skills within the organisation albeit at a very low number (currently only four in the Geospatial Imaging team including our new apprentice) which may become further reduced in future years due to its ageing geospatial workforce. So as well as continuing to promote the use, capture and application of geospatial data across the organisation it will need to consider career options across geospatial related areas through possible recruitment of new posts as well as increased application of the geospatial apprenticeship scheme.

One area that has not been investigated yet but may contribute to much wider geospatial skilling is secondment from industry where trained geospatial surveyors from private, commercial practices are paid to spend for example a year working with other end-user sector groups, and organisations such as Historic England to both pass on their knowledge of capturing geospatial data and learn about how it is and may be applied.

In terms of promoting careers in the sector there are already various portals that can be used such as provided by the Royal Institute of Chartered Surveyors (https://www.rics.org/uk/careers/), the Chartered Institute of Civil Engineering Surveyors (https://www.cices.org/recruitment/) and The Survey Association (https://www.tsa-uk.org.uk/job-opportunities/). Therefore the Commission may wish to pro-actively promote these opportunities whilst investigating providing a portal that gathers together all existing recruitment paths and provides a free to use 'one-stop-shop' for those interested in pursuing a geospatial career.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Historic England (HE) uses a corporate GIS system that provides access to a wide range of HE, English Heritage and other business data as well as historic and modern Ordnance Survey mapping. This is a fundamental tool used by many within the organisation and provides important information for consideration within many external heritage projects and research initiatives that HE is involved in. The organisation also previously benefited from joining the Pan Government Agreement which although costly to implement provided access to extremely valuable imaging, mapping and lidar datasets at different scales and resolutions across the country. More recently Historic England has a new 'Aerial Photography of Great Britain' (APGB) agreement which provides access to aerial photography and height data sets however as it is centrally funded by Government there is no longer any cost to the organisation during the current two year agreement. It is also making increasing use of lidar coverage provided by the Environment Agency and which now forms one of the key baseline datasets when undertaking aerial investigation and mapping work.

All of these highlight an abundance of geospatial datasets at a range of scales, formats and accuracies that are already available and beneficial to Historic England and the wider heritage community through the different supplier agreements. However maintaining their 'currency' and access comes at a cost, which must be borne by someone, together with varying licensing implications before data can be widely used. Therefore it is hoped the Commission and government continues to support such availability of world-class geospatial data from partner bodies whilst ensuring it is affordable to both public and private end-users.

One interesting area is the increasing collection of mobile scanned datasets within urban and (some) rural areas of the UK. This is typically collected by commercial contractors who have purchased mobile scanning systems or by the manufacturers themselves within their testing and implementation programmes. Such systems typically involve multiple scanners/imaging units mounted on a vehicle that collect geospatial data 'on the move' in both point and image forms thereby allowing the rapid mapping of entire urban areas. Some commercial contractors are already looking to commercially exploit these datasets to third party customers whilst others have yet to consider it. Access to such data could be extremely beneficial to heritage users during conservation planning and area characterisation projects for example however the costs are currently prohibitive so perhaps the commission could consider means of funding access to this valuable resource?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Within the heritage sector it is not anticipated there'll be much change to the address system currently used that'll dramatically affect work undertaken by heritage organisations such as Historic England and English Heritage. However as the geospatial location of heritage assets is a vital component within their recording, investigation, analysis and potential listing it is important that positional accuracy is maintained to ensure we know 'where on earth they are' and to derive accurate three dimensional co-ordinates using Global Navigation Satellite Systems (GNSS) enabled technology (see https://historicengland.org.uk/images-books/publications/where-on-earth-gnss-archaeological-field-survey/). However there are other ways to 'address the world' and provide an accurate location for an object, person or asset such as what3words which is a simple yet very effective way to talk about location (https://what3words.com/) so should be considered within any proposed changes to the address ecosystem.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The heritage sector already makes use of earth observation data within large-scale archaeological assessments and characterisation projects. Although there appears an abundance of satellite-based data to potentially exploit in both visible and non-visible spectra it is typically limited by image/data resolution, availability(both in terms of area/position and time) and cost meaning that only the larger, better funded projects fully embrace it. Therefore the heritage sector would welcome the commission looking at widening access to existing earth observation data via 'one-stop-shop' portals and at a cost to the end-user that they can afford and is not prohibitively expensive to use and maintain.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Drones - currently one of the major growth areas in the geospatial sector they are increasingly being used across a variety of heritage applications including digital documentation of archaeology and architecture, condition survey, interpretation surveys, presentation and geospatial mapping. They also provide a highly manoeuvrable platform for mounting other sensors such as cameras, lidar units and hyperspectral imagers so an obvious technology to focus on, develop and exploit.

Mobile laser scanning/lidar – the introduction of Simultaneous Localisation and Mapping (SLAM) algorithms, small format Inertial Measurements Units (IMU) and high definition panoramic imagers are providing exciting new opportunities to capture the geospatial space around us 'on the move'. Such rapid data collection approaches combined with increased accessibility into spaces previously difficult to survey provides a massive opportunity to enhance the mapping of both internal

and external spaces.

'Structure-from-Motion' (SfM) - photogrammetry is a mature survey approach that has massively contributed to the mapping of the world's landscape since it was first used in the 1850's. Since then stereo-photogrammetry has gone on to be the principle technology behind the detailed mapping of the UK by the Ordnance Survey as well as assisting in the recording of England's heritage since the 1970's. However it has always suffered from a perception of being expensive, complicated and overly-accurate meaning that historically it has been an approach used only by specialists. The introduction of Structure-from-Motion around 2010 that included the automated generation of point data from multiple overlapping imagery, has democratised photogrammetry and made it fashionable meaning that both specialists, non-specialists and even the general public can all now enjoy exploiting it.

Geophysics – there is already an abundance of techniques to map and record the above ground landscape and a similar level of technology to assist underground prospection…but typically not together thus providing a developmental opportunity for integrated above and below ground solutions.

3D enabled smartphones – the integration of 3D sensing technology within smartphone devices inevitably allows members of the public (that can afford it) to three dimensionally record the space thereby contributing new geospatial information for others to use and potential crowd-sourced imagery for research application.

AI enabled analysis of captured datasets – there are already numerous means of generating three dimensional geospatial data but other than for presentation, such information needs analysing to provide useful and meaningful outputs. As well as automatic line drawing generation, which remains 'the holy grail' for the geospatial community, the benefits of artificial intelligence need exploiting to both speed up and improve upon the post-processing of captured imagery/data and its analysis.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

By definition geospatial data makes available information relevant to location however instead of providing just one layer it would be incredibly useful if future technologies could supply multiple layers of information at the same time.

light field cameras that capture all the light rays around the sensor and enable the later adjustment of focus at any point in an existing picture provide future scope for light field photogrammetric mapping across all scales and applications

hyperspectral sensors that capture data in multiple spectral bands as opposed to just RGB thereby providing future scope for integration with laser scanning/lidar systems and the provision of spectral signatures for different surfaces that could potentially assist Building Information Modelling (BIM) applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector organisations such as Historic England can help maintain the quality of geospatial datasets through the publication, maintenance, revision and updating of standards relevant to its heritage field. For example the Historic England "Metric Survey Specification for Cultural Heritage" that is widely used by heritage professionals when specifying survey work throughout the historic environment sector and by academics researching building conservation (https://historicengland.org.uk/images-books/publications/metric-survey-specifications-cultural-heritage/). However such work takes time and money so is dependent on suitable funding continuing to be available at appropriate levels.

It may also be useful for public sector organisations to regularly meet with their counterpart teams working in the collection and use of geospatial data. For example Historic England, Historic Environment Scotland (HES), CADW and the National Trust now meet up annually to discuss Building Information Modelling (BIM) and associated digital documentation technologies and approaches.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

For any geospatial surveyor the observation of accurate control using GPS/GNSS and conventional total-station technology still forms an important first step within any survey. This indirectly relies upon the expertise that goes into maintaining the geodetic networks and frameworks that support it so should remain a priority for the commission. However as GPS/GNSS still doesn't typically work indoors, it appears sensible to focus development on control systems that can seamlessly continue indoors and help maintain the accuracy of geospatial data beit outdoors or indoors. This would then help the majority of surveys undertaken in the UK and the emerging use of mobile scanning systems that can seamlessly capture data outdoors and indoors thereby maintaining accuracy levels throughout.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector typically carries out the majority of geospatial surveys in the UK so it appears sensible to include them with the development and maintenance of the underpinning structure seeing as they will be the main ones applying it. Due to the numbers of surveyors involved this may have to be through sector representatives for which Historic England could contribute on behalf of heritage users. Other areas may be represented by their professional organisations such as the RICS, RIBA, CICES and TSA.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As mentioned above one of the challenges is maintaining the quality of geospatial data which in the case of Historic England is assisted through the use of a standard specification (https://historicengland.org.uk/images-books/publications/metric-survey-specifications-cultural-heritage/) that describes all the components that comprise an accurate and 'fit-for-purpose' survey. However as there are other specifications available that could typically be used in similar applications (such as https://www.rics.org/uk/upholding-professional-standards/sector-standards/land/measured-surveys-of-land-buildings-and-utilities/) it is essential to engage with other sector organisations so as not to 'reinvent-the-wheel' or generate a standard that is unrealistic and overly expensive to apply. One final challenge is ensuring a suitable level of metadata is included in the geospatial data so as to allow it's archiving and future re-use. It's often challenging to get private sector surveyors to engage in metadata discussions therefore it is perhaps the role of public sector organisations such as Historic England to work with experts in the field, such as the Archaeology Data Service (http://archaeologydataservice.ac.uk/) to develop appropriate metadata standards that others can realistically apply.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

As well as making the UK geospatial industry more aware of what the Geospatial Commission is it should initially bring together partner bodies and other public bodies to gather their collective thoughts on geospatial data collection at all scales and across all types of application. Only by doing this will a much wider picture of the nation's geospatial landscape be collated whilst breaking down any perceived siloes and maximising awareness across all partner teams and groups.

Historic England would welcome the opportunity to be included in this and represent the views and needs of the heritage sector and, if appropriate, contribute to a number of enabling data projects…..perhaps including one relating to Building Information Modelling (BIM) that can act as a representative industry example of sector collaboration to aid the future-life-cycle of an asset.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The list provided in the strategy already appears comprehensive and should provide significant geospatial datasets for other public sector bodies to use and exploit. In the case of heritage it is often vital to see the historic development of an area/landscape over time which is where collections such as those held in the Historic England Archive (https://historicengland.org.uk/images-books/archive/collections/aerial-photos/ & https://britainfromabove.org.uk/) as well as exciting new discoveries imaged by HE's own Aerial Investigation and Mapping team (https://historicengland.org.uk/research/methods/airborne-remote-sensing/aerial-investigation/) become vital geospatial assets that more geospatial users should be made aware of.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Not every UK geospatial surveyor is aware of the regional strategies under which they operate so it would make sense for the Geospatial Commission to host an initial Geospatial Conference at which the different strategies and the geospatial work of partner and public sector bodies could all be discussed. As well as raising general geospatial awareness there could be sub-group workshops managed by professional facilitators that could be tasked with teasing out the general themes from each regional strategy that provide the core of the single UK document. This could then be considered by the regional groups and regional variations added where necessary.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Rather than dictating what local authority teams should do it is best to let them speak and then try to integrate their views and concerns. So as well as inviting local authority representation at the above conference the regional sub-groups could be tasked with gathering the thoughts and views of their local representatives perhaps through their own regional/local version of the Geospatial Commission conference.

Also as occurred with the recent DfT stakeholder workshops on drone regulation it would be very useful to get a representative public viewpoint on geospatial data both as means of raising awareness on what it is, how it is captured and how it is used.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The property and land initiative potentially includes a heritage component which can already be assisted by locating listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields through the use of existing tools such as https://historicengland.org.uk/listing/the-list/. This could also assist infrastructure and construction and mobility when assessing the impact of service and transport routes on the heritage landscape. Natural resources potentially bring in benefits for heritage prospection if remote sensing technologies are used that might capture unknown structures from multi & hyperspectral analyses. Sales and marketing potentially brings in knowledge of what used to be at a particular location through virtual and augmented reality integration of historical imagery and geophysics data if available for a particular site.

Q18: Are there any other areas that we should look at as a priority?

Tourism – all the above initiatives will contribute geospatial data that could be used for tourism purposes beit simply via a website for an area of the country or potentially through a computer game that might attract a younger viewer. For example the enormously successful computer game 'Assassin's Creed' has been able to blend an action-adventure stealth video game with a series of historical backdrops resulting in a new discovery tour depicting different civilisations as a living museum. Is there scope for an Assassin's Creed Discovery Tour of the UK that builds on the wealth of geospatial data we now have access to?

Security – given the physical and virtual cyber threats posed to the UK's national security it appears sensible to at least give some thought as to how geospatial data could be used from the tracking of threats across the UK through to heritage crime events such as the theft of lead work from churches.

Climate change – the worlds weather is changing and so are the climates we experience so given this may only get worse it would be useful to include this as an initiative to test how geospatial data could contribute to climate change initiatives such as carbon and pollution reduction.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Private potentially refers to more localised capture of geospatial data whereas public sector infers regional and national capture programmes. Therefore there appears to be scale differences in the technologies used that will differentiate their derived outputs.

Drones appear to offer so many innovation opportunities however geospatial data collected via them will be subject to the current CAA regulations surrounding the flying of drones in the UK but if this is to be exploited within initiatives such as mobility, how will public privacy issues be overcome?

Similarly even though the capture of mobile mapping data within urban centres is not subject to any regulation the imagery and point data it captures and the post-processed outputs it generates could be challenged on public privacy and possibly data protection grounds.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

As well as raising the profile of the UK's geospatial industry through increased representation at global conferences and leveraging geospatial issues into the work of government ministers, could the Commission recruit a geospatial guru/evangelist/tsar to promote our work on the world stage?

In the case of heritage the country (and world) took notice when one of the nation's iconic landmarks, Stonehenge appeared in the news when the first laser scan survey of the monument was announced in 2011 followed by the results in 2012 that unlocked some of the secrets of this world famous structure. More recently the work of Historic England's Aerial Investigation and Mapping team hit the international headlines when the hot dry summer revealed hidden archaeological sites in England (https://historicengland.org.uk/whats-new/news/hot-dry-summer-reveals-hidden-archaeological-sites/).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Drones are an obvious comparison point both in terms of regulation and application.

BIM has not been mentioned so much in the strategy or this call for evidence however remains an approach that is set to develop even further and potentially spread into other non new-build construction areas such as heritage. It would make sense to look at BIM comparisons overseas and perhaps seek the views of BIM4 groups such as www.BIM4Heritage.org that now have increased international membership given there is little similar activity in their own countries.

Heritage survey where the work of organisations such as Historic England is already well respected internationally.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Historic Environment Scotland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Non-departmental public body**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial skills continue to be seen as a niche and specialist activity and remain undervalued in many Institutions even though they underpin most decision making activities.

There should be a strong emphasis on training and raising awareness of how geospatial data contributes to society and decision making from an early age.

The long term value of geospatial data needs to be addressed: very little thought has ever been placed in the archival requirements of large ans complex data. Geospatial data should adhere to the FAIR Data principles.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

General
Despite the inherent relationship between geospatial data and heritage, the contribution of spatial data to our understanding and management of the historic environment has never fulfilled its potential. There is a lack of cohesion and coordination across the discipline.

Shortcomings can be addressed through examples of best practice, leadership and investment to realise the potential of the data we create and curate.

Geospatial industries are fast moving and whilst Historic Environment Scotland has cutting edge projects mapping climate change, maintenance of our estate and convultional neural networking applied to automated feature extraction from remote sensing data, skills are embedded in a few individuals.

A key challenge for the historic environment is the fragmented approach to creating and curating spatial data which is spread across public sector, private sector, academia and increasingly community driven projects.

More generally, innovation through combining datasets from different disciplines remains elusive. Semantic Web approaches that can deliver novel cross-cutting solutions have a high technical threshold beyond most data users and lack user friendly interfaces.

Skills
Junior technical GIS/geospatial jobs are non-existent in our organisation. This would be important to give graduates entry level jobs into the Geospatial sector. These roles would free up time for senior Geospatial roles who could focus on analysis, value adding processes, and strategic documentation.

We do not have enough programming skills, any AI and Deep learning skills which could add value to our spatial data so we can predict trends, analyse

change etc.

A corporate spatial data management role to manage core spatial data to accepted standards

Standards

Government/ the Commission could direct that nationally important spatial datasets to be curated/managed to an agreed standard

The commission could publish a best practice GIS/informatics organisational structure for managing spatial data

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

A significant portion of public sector data is now available to other public agencies across Scotland but not all of that data has been released under open licences.

Land registry data is often behind a paywall.

With the exception of ortho-imagery, accessible through a public sector agreement, most industry data (utilities etc) remains difficult to access.

The Historic Environment Record from Local Authorities could be managed to a better standard. This could be done by the adoption of a similar 'open' spatial data management database, instead of a proprietary systems, across the sector and also through investment in a GIS data manager role in each local authority.

Most public geospatial datasets are **challenging to access** for the general public. Even though introducing initiatives such as INSPIRE and Open Data, Geo data dissemination technologies are not user friendly, or data is behind subscriptions, **paid services** or only accessible through ad hoc enquiries. Some examples below:

- **Challenging to access**:
    - Improvement service
    - Canmore
- **Paid services:**
    - NCAP
    - ROS

- Scotlands people
- Statistical accounts of Scotland

Google just published a beta data search tool which seems at the first glance much more user friendly than other search portals:

https://toolbox.google.com/datasetsearch

However, there does not seem to be a Map portal, plotting the data search results successfully on a map.

Establishing a map portal that searches and displays global open geo data set's would simplify, add value and improve access.

This would solve some of the difficulties to access open data but will not tackle geo data locked behind subscriptions, or geo data that has not been digitised yet.

Establishing a survey or research projects on the following three key areas may help to resolve some of these issues:

1. **Improve and promote user accessibility** for open Geo data. (Geo data that is already digitally available and following open standards)
2. Establish how to **improve access** to Geo-Data that is available digitally but is **locked behind paid services**.
3. Establish valuable analog geo data hidden in archives that would benefit from digitisation (E.g historical aerial photography, historical maps, name books).

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A freely accessible definitive spatio-temporal address gazetteer in Linked Data format is essential to ensure consistency and interoperability across datasets

How are offshore locations addressed?

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Provide appropriate technological solutions for the anlysis of Big Data from stellites and other remote sensing programmes.

The long term value of geospatial data needs to be addressed: very little thought has ever been placed in the archival requirements of large ans complex data. Geospatial data should adhere to the FAIR Data principles.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Big Data analysis through automated feature extraction and identification from satellite and other remote sensing data

Semantic Web solutions to enable novel approaches to combining data

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Identify and support (through funding initiatives such as the Catapult Programe) key challenges to encourage innovation and collaborative working across discplines to deliver innovative solutions.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector organisations need to recognise that they hold geospatial data and that it is relevant to other users. They need to think about the long term storage and access to that data.

Where feasible, public sector data needs to be meet the FAIR Data principles. Newly acquired data (either created directly by the public sector body, or bought in from an external source) should include clauses ensuring the preservation of the data in a recognised digital archive and reuse under Open Data terms and conditions.

The Geospatial Commission needs to recognise the high threshold for archiving digital data and that these costs can be prohibitive. There is a need for recognised archives to take, manage and share that data and that (some of) the cost for archiving and dissemination is included in all projects from the outset.

There could be a mandate from Government/the Commission to manage data appropriately to allow the data to be reused and value to be added. This could be done be sharing best practise across government sectors and allow developments to be shared/scaled up across organisations.

In order to continue to invest in maintaining and enhancing our gepspatial data assets we need to:

- **Promote** them, which includes the **education** and **training** of users and demonstrate the benefits.
- **Make them available** more easily
- **Add value to the data**. (E.g. can the data be used for analytics to predict trends, reduce costs, make predictions and create case studies to understand scenarios).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Consistency: everyone should have access to the same key reference datasets without restriction.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The part commercial, academia and community archaeology projects in contributing to the geospatial knowledge of the historic environment needs to be acknowledged.

There is a need to ensure that the data they create is available for reuse without restrictive barriers.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Access is generally acceptable across central government agencies but there are still barriers in reuse of local authority data by national bodies.

Discoverablity
SDI catalogues present a very poor user experience. Whilst these fulfill a technical function, they are not user friendly.

Highly technical datasets (e.g.remote sensing data) needs to be supported by relevant technical data that allows the potential user to explore the metadata to asses if it is fit for purpose.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Use the leverage that the Geospatial Commission has to effect change. Establish targets for data owners to aspire to.

Benchmark where we are and where we want to be.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The Geospatial Commssion can set the overarching framework to enable implementation and cascade the priniples down through regional and thematic groups.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Run awareness raising sessions aimed at existing special interest working groups established by local authorities on a regional or thematic basis. Lead by example.

Q17: Are there any other areas that we should look at as a priority?

Climate change .

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Dialogue with continental partners

Leading by example and promotion of success stories

Partnership projects

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

INSPIRE
OGC

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	HM Land Registry (HMLR)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]
Enquiry point for response queries	[Text redacted] [Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	

Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

HM Land Registry agrees that it is helpful to set out what is meant by 'Geospatial Data' as part of the planned UK Geospatial strategy. HMLR considers that the definitions of Geospatial Identifiers and Geospatial Services are clear and unambiguous. However, it is unclear what the intention or benefit is in defining Geospatial Data and Position Data separately, and we believe that only one combined definition is necessary. As drafted, there is the potential for confusion without further explanation and illustration about how the phrase 'groups of individual datasets that usually have location as a secondary purpose' in the definition of position data would apply in practice.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

HM Land Registry advocates supporting innovation within the Geospatial sector as demonstrated through our sponsorship of a number of digital start-ups through the Geovation programme, our ground-breaking Digital Street R&D project and our commitment to releasing datasets so that innovators can combine property information with other types of data for all kinds of useful information and new services. Enabling and developing skills capability should be a key strand of a UK Geospatial strategy and the call for evidence sets out a number of welcome steps the Geospatial Commission will take including to work with leading representative bodies such as the Association of Geographic Information, which is working to provide CPD for the geospatial community including systems providers and integrators, data creators and data consumers.

HMLR believes the Commission should focus on finding ways to improve skills in general data literacy, spatial analysis and interpretation. It should seek to include geospatial skills within core computer science programmes and integrate geospatial awareness skills into other mainstream professional training and development, for example in construction and engineering.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

HM Land Registry exists to register ownership, interests, mortgages and other secured loans against land and property in England and Wales, with our geospatial data traditionally being seen as a secondary by-product of our primary purpose. However, our new Business Strategy puts the use of geospatial data firmly at the heart of our objectives and our aspiraton to become the world's leading land registry for speed, simplicity and an open approach to data.

HMLR currently holds records for more than 25 million registered titles, covering more than 85% of land in England and Wales, providing a reliable record of ownership of and interests with a title which is guaranteed by the state. HMLR has one of the largest geospatial workforces in the country, who use their spatial judgement and expertise on registration casework, building their skills through experience. In addition, HMLR requires more specific and specialist geospatial analytical skills that are particularly difficult to recruit into, as well as a need for data scientists, especially those with a data science or Machine Learning background.

HMLR believes that careers in the sector can be best promoted through industry bodies such as RICS or AGI and through mainstreaming geospatial elements into wider professional training as per our response to Q2.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

HM Land Registry is not hindered in delivering its existing statutory functions due to difficulties in access to or quality issues with specific geospatial datasets.

HMLR believes that in developing a UK Geospatial strategy the Geospatial Commission should ensure that datasets be available on a broad and accessible basis, with the content and 'form factor' of datasets reflecting clear user needs and/or providing an opportunity to innovate. HMLR has direct experience in prioritising geospatial datasets for publication based on a user-centric approach. HMLR's approach has enabled the organisation to create a sound view of user need, potential use cases and to understand the potential economic and social value that would be realised for each data release. HMLR is committed to releasing as much information as it can from the statutory land register as part of its 2017-2022 business strategy.

HMLR would support the bringing together of cross-government data to enable a more strategic view of property and ownership assets, subject to data protection requirements.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

HM Land Registry recognises address data as a complex subject that has challenged the UK public sector for many years. HMLR understands that the economic case for (and technical solutions to create) a single, authoritative, open source of address data have been defined several times without being taken forward. HMLR's geospatial data contains address data from external sources, which restricts our ability to grant open re-use our data. HMLR believes this would be a useful priority area for the Geospatial Commission to resolve as part of a UK Geospatial strategy as it will require commercial and political challenges to be overcome.

Addressing is, however, a very complex issue as property titles on the land register do not necessarily match easily against specific addresses and some property titles are considered to be "unaddressable" as they refer to land parcels that are not represented by traditional addresses. Multiple titles may form a single address and one title can incorporate multiple addresses.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

HM Land Registry sees value in satellite-derived earth observation data for supporting the practical application of land registration. HMLR believes that a healthy housing and construction industry could benefit from freely available national data coverage of low altitude, off-nadir imagery especially of building facades; and of LIDAR (a Light Detection and Ranging survey methodology) terrain and feature models.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Many public-sector organisations have large holdings of geospatial data in inaccessible and unusable formats, e.g. paper or scanned images. HM Land Register would encourage the Geospatial Commission to focus on enabling new technologies which can liberate this latent information, such as Artificial Intelligence, Natural Language Processing and Machine Learning.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

HM Land Registry's 2017-2022 business strategy sets out ambitious plans to help the organisation become the world's leading land registry for speed, simplicity and an open approach to data. Delivering the strategy will transform and modernise the organisation and its services. HMLR has a digital transformation programme that includes initiatives (through Digital Street) using geospatial data to support innovation in land registration and the conveyancing process, and for innovating companies able to use open data and provide new technologies and services for businesses and consumers.

The call for evidence identifies a number of future technology areas (5G, drones, autonomous vehicles) where geospatial data offers opportunities for innovation and to deliver benefit and value. Other areas might include building on rooftops and energy production.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

HM Land Registry notes that the Call for Evidence says that its partner bodies, and other public sector organisations, must adapt to the evolving geospatial environment and support innovation. The Call for Evidence also says that business models need to enable them to maximise the opportunity for users to gain value from the data while supporting development of geospatial assets that are held. HMLR is funded through the fees and charges it makes for the services it provides and is not a profit-making organisation. HMLR's 2017-2022 business strategy sets out ambitious plans based on a medium-term financial strategy which provides for digital transformation that will enhance the information held in its registers and support commitments to release datasets for the benefit of end-users, including innovators.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

HM Land Registry believes that a UK Geospatial strategy should be comprehensive and relevant to all sectors with an interest. The UK should retain its leading role in the existing global standards' communities for GPS and geodetic networks and frameworks that set parameters. The Commission may wish to consider whether to encourage open protocols for indoor positioning technology.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

HM Land Registry recognises that there are organisations in the private sector that already hold an important role in the underpinning infrastructure as geospatial data holders, for example utility companies. HMLR would welcome a UK Geospatial strategy that encourages private sector geospatial data holders to share their data appropriately, and in a similar way as for public sector organisations. HMLR equally recognises the increasing role in the economy that the private sector can play in creating new markets and services that use geospatial data, which in itself will oblige data holders to ensure the integrity, quality and accessibility of their data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

HM Land Registry notes that the Call for Evidence wishes to encourage collaboration among the public sector generally, and to 'foster collaboration by default' between the six partner bodies. It notes that the Geospatial Commission has set up governance arrangements to bring together the six partner organisations at both technical and policy levels under a framework arrangement. HMLR is committed to working with the Commission and the other key partner organisations, learning from past experience and seeking new and mutually beneficial opportunities going forwards. HM Land Registry would for example benefit from access to data on square footage and detailed property use that is held by the Valuation Office Agency. The initial 'Geo6' projects under consideration and those already announced are focussed on overcoming acknowledged general barriers such as (but not limited to) lack of data specifications, poor interoperability, quality and currency, cost and inconsistent licensing. HMLR considers that the Commission has a key role to play in championing the implementation of previously defined solutions to some of these barriers to enable the creation of a viable national spatial data infrastructure that might otherwise not occur without compulsion or inducement to change.

HMLR would suggest that the Geospatial Commission must actively recognise that the users and sources of geospatial data across government extends far more widely than just the Geo6. Other government departments, such as DEFRA and MHCLG produce, use and store geospatial data and these departments should also be included within the ambit of any future plans.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

HM Land Registry believes that the Geospatial Commission will need to strike an effective balance between acting as a geospatial data customer for the public sector as a whole and permitting individual organisations in the public sector to act as customers – as well as providers – in their own right. HMLR believes that the Commission will need to establish its approach as a customer including around:

- Contractual controls, including for determining product specifications and quality levels and to withhold payment for poor performance;
- Representing public sector data users by engaging with the Geospatial Information Group and the PSMA User Group;
- Acting as an advocate and champion for software and services, including through .Gov; and
- Encouraging better understanding across central government generally of the collective public sector data agreements.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

HM Land Registry has committed to making its data accessible and free of charge wherever possible and appropriate in line with its 2017-2022 business strategy. This will be subject to individual business cases being approved for each data-set release. This aligns well with the aims of the Geospatial Commission and plans to develop a UK Geospatial strategy.

HMLR believes that data on property types and land use held by the Valuation Office Agency would complement HMLR data and be of value to the housing and construction industries.

In addition, HMLR would like to see more government data about property made available freely where possible. This would include key datasets in local government. This data would benefit the property market in two ways. Firstly, it would enable property developers and policy makers to identify more easily land for development, enabling more houses to be built. Secondly it would enable those involved in the home buying process to understand more easily the risks and rewards of a proposed transaction. Were this data available to all earlier in the process of transacting on land or property decisions could be made faster and contracts signed earlier than today.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

HM Land Registry welcomes the Geospatial Commission's acknowledgement of involving devolved countries in developing a single UK Geospatial strategy and would encourage an expansion of the governance arrangements to enable that wider experience to be brought into discussion with the key partner bodies. However, HMLR also believes that the Commission should ensure that as wide a set of contributing government bodies be involved as possible in developing the government's Geospatial strategy, including other land registries, such that there is not an over-emphasis on the existing 'Geo6' key partners.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

HM Land Registry would be willing to share its experience with the Geospatial Commission in working closely with local authorities to create a new national Local Land Charge service that is being rolled out under the Infrastructure Act 2015. HMLR also believes that the Commission might learn from experience held in organisations such as the Government Digital Service.

However, HMLR recognises that local authorities are independent organisations and will need to be reimbursed for cost incurred and income lost.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

HM Land Registry looks forward to working with the Geospatial Commission on a number of the key use cases described in the Call for Evidence paper, especially those cited in the Land and Property and Infrastructure and Construction categories.

Q18: Are there any other areas that we should look at as a priority?

HM Land Registry has not identified any other priority areas and is intending to work with the Geospatial Commission on a number of those already identified. It is interested to learn what other organisations propose as priorities in case any of those offer relevant opportunities for HMLR to improve its statutory services and transformation agenda.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

HM Land Registry has a number of statutory responsibilities set out in primary legislation, and regulations set out further detail. It takes these into consideration – and any regulatory changes that might be required - when developing its strategy and policies and including in its research and piloting initiatives around new innovations.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

HM Land Registry considers the UK should take a proactive role in international organisations setting global and international standards that are relevant to a UK Geospatial strategy. The Geospatial Commission should also explore international opportunities through government organisations, including the Department for International Trade and FCO.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

HM Land Registry notes that the recognised international exemplar countries for Land Registration and Spatial Data Infrastructures include New Zealand, Singapore, Estonia, Netherlands and Denmark. Each of these countries is able to demonstrate a consistent, cross public sector approach to geospatial data infrastructure and delivery.

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Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Homes England
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial data, - data not always have an obvious emphasis on place – but adding location intelligence to it can enable greater data analysis

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Embed spatial literacy elements into mandatory subjects in education – starting with primary schools and continuing through secondary and tertiary education (basic map creation and reading skills, interactive games with navigation, AI, VR etc.)

General skills for all staff within public sector from top down to break myths of GIS only being for highly skilled specialists and geeks! Raising a general awareness of the geospatial sector.

Basic data and analysis skills are needed so that policy makers and information commissioners understand the inputs they will receive (quality, formats etc.) and

the potential burden it places on the providers due to changing formats and inflexible systems

A better understanding of Big data and analysis techniques

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

General levels of geospatial comprehension are low. Team suffers from historic perceptions of our outputs being purely map based. The GIS software will analyse the data but does not need to be used to present the required data back to our internal clients. Often only the headline figures are required.

Within the geospatial team, we also need to build up the analytical capabilities. Currently analysis is often thought of as reporting back data however we need to develop skills in order to challenge whether data can help up develop strategy.

Visualisation skills bringing analysis to life through drone derived models, BIMs, VR, AR etc.

CPD in general Geospatial topics is lacking – online training courses and opportunities to engage with the Head of Geography and Geospatial Commission more directly would be good – this will help to break down barriers

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Priority should be given to public sector processes that are inefficient and costly and have an element of public facing activity such as planning applications.

Providing access to planning application boundaries would provide huge benefits to Homes England and other public sector bodies when assessing and monitoring sites.

Capacity and location of utilities - identifying this intelligence is both costly and time consuming. This would help all players in the development of land including SMEs who struggle to obtain this information when making investment and delivery decisions.

Breaking down licencing barriers or procured datasets (base mapping, addressing, etc) to enable us to share and collaborate with partners.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Lag time between completing a house and registering a delivery address and creating an address record needs to be closed**.**

Important for monitoring of housing completions/ delivery, connected autonomous vehicles.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

By entering into collaborative projects. We should be using a collaborative approach in terms of collecting and analysing data (e.g.for climate modelling)

Ensure there is sufficient storage available to hold reams of data
Ensure data is easily accessible and frequently updated

Ensuring capability unaffected by Brexit

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Continuing to enhance geospatial technology to support development of self services intelligence sites
Geospatial collaboration tools to encourage joint working

VR/AR for visualising and considering potential development options for a piece of land

AI for tracing the spread of diseases, patterns of population movement etc.

Drones capabilities to support creation of geospatial data

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial technology and applications will be pivotal in the development of smart cities.

Use of sensors to understand peoples movements and interaction with the built environment will encourage better design

Use of geospatial to understand global change to electric car (position of charning stations, etc)

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Get more support from Central Government – goes back to the understanding at all levels of how data should be captured, structured, used and presented effectively

Produce easily understood and achievable standards

Provide software/ web interface that helps ensure greater data quality and enables new standards to be adopted relatively burden free

unclear formats, no point of entry validation of values , no standards = no consistency in the data limiting future use for analysis and so on.

Technology to speed up lengthy and inconsistent public-facing public sector processes, such as planning applications, land transfers – this will provide a better

experience for the public but will also provide a wealth of data for industries (both public and private) to use for their own purposes.

Provide more carrots and sticks if necessary to ensure data quality and standards are taken more seriously

Improve central data repository such as data.gov – data is extremely hard to find and authoritative datasets are not clearly marked etc.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Increasing accessibility to sensor and GPS information which could support our understanding of place.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector is critical for the development of geospatial data however need to adopt the same standards and connectivity as government (open, related, data) if going to be effective.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Finding datasets easily – knowing who holds what, which dataset is current, authoritative etc. Data can be available in many different formats and with varying levels of data quality, can be captured at different scales and at different timescales making analysis more complex.

Some datasets contain sensitive information and owners can be reluctant to spend time anonymising the data so it can be shared as this is an extra burden for them

Standards are required – inspire is a possibility but maybe overly complex? Standards ensure consistency and enhanced data quality

Data should reach a particular standard before it can be submitted; validation at the point of entry would help with this.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Help economies of scale and value for money – strength in numbers
Help bring together customers who may not have known they have common or complimentary requirements.

Can be a stronger voice to help enforce standards, best practice, data sharing.

The Commission can consult with public sector representatives to understand user requirements and monitor usage of datasets to help ensure procurement of data is efficient and remains relevant.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Land Values at a local level

Services infrastructure such as utilities – we understand that the data is often modelled and has a commercial value but this is an area that is required for investment and delivery decisions – especially in terms of remaining and future capacities to supply to a particular location. Ideally data would include pipe networks, locations of WWT works, available capacity of utilities and broadband services.

Planning application boundaries

Transport

Should be delivered as 'Data as a service' wherever possible

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Ensure DA strategies feed into a national picture and build a set of shared minimum standards and aspirations

Encourage the sharing of best practice and lessons learnt to ensure the National Strategy brings together a deliverable set of standards etc.

Pull commonalities together but still acknowledge the unique elements that will relate to each DA area

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The Commission needs to help ensure that central government departments understand more of what data is actually required (recognising the burden on data supllers), how it will be shared and used.

Data requesters need to think 'outside of the box' so that data collected can be gathered once and used may times for a wide variety of uses.

Create a webpage for all of the public sector – not just LAs where best practice can be celebrated, members can be signposted to data and apps they may find useful etc. This could include a two way feedback mechanism for LAs so they can discuss issues and feel supported by the Commission. Working with the LGA would also help here.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Site appraisals

Monitoring of development schemes

Masterplanning

Public consultations

Q18: Are there any other areas that we should look at as a priority?

Population characteristics – not simply census data.

Need to be able to identify what kids of people live where – e.g.where the most vulnerable members of society living so interventions and assistance can be delivered to them in a targeted, cost effective manner

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Electric / Self Driving Vehicles
Digital Masterplanning

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Collaborative projects with international partners

Increased promotion of projects and R&D both within the UK – successes highlighted across all levels of business and Government to raise awareness.

Geospatial focus at key cross industry events (for example, geospatial currently quite light at housing events)

Encourage people with a stake or an interest in the Geospatial world to use social media more – tweets, Linked in etc.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

America. Also understand places like Dubai are quickly developing in this space.

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About you and your organisation

Name	[Text redacted]
Organisation	HR Wallingford
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I think that this refers to the list of four items on page 12 of the 'Emerging geospatial strategy'. If so, then I'm not sure of the value of this as it seems to introduce a set of jargon associated with aspects that are well understood.

'Geospatial data' is fine but I find the definition of 'Positional data' a little tangential and misleading. Surely it is sufficient to say that some data is not principally geospatial, but has a geospatial aspect to it?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I regard the following as of strategic importance:

- Interpretation and processing of Earth Observation data from satellites.
- Emphasis on programming as a key skill and promoting a higher standard of software development from those who have begun with GIS.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Again, we are always looking for good programmers. Perhaps people don't go into programming because of the abstract nature of it. However, programming with geospatial data has immediate relevance to real-world activities and produces results which are usually pleasing to the eye!

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

I am aware that the military holds a large amount of bathymetry surveys. These would be of value to us for running and calibrating numerical models of the coasts and oceans. We would be interested in participating in projects or initiatives to leverage the value out of these holdings, both in identifying those that would be useful and putting processing and delivery pipelines in place to achieve this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

I can't see any immediate benefit in changing this. If it hasn't been done already, then linking address data to a common coordinate system (e.g BNG) would probably suffice for most applications.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

This is a key area. For me, the main enablers are understanding and usability. At the moment, those looking into EO data are faced with a sea of acronyms and technical terms, written for the convenience of the suppliers not the users. A more user-facing approach needs to be taken.

Our users ask three questions:

- What parameters are being offered? This information is usually presented at a level too close to the raw instrument output and not in terms of parameters that the users will understand.
- What is the spatial and temporal coverage? This is usually very difficult to ascertain.
- Am I licensed to use the data? This information is often missing or is very unclear.

There is a real opportunity to present EO data in a far more usable fashion to enable faster uptake and clearer analysis of its utility. Businesses will not spend ages trying to understand what's on offer.

Also, a key skills area lies in the processing and interpretation of EO data.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

It is consistently difficult marrying up topographical data on land with bathymetric data in the sea. Technologies which focus providing consistency along the shoreline and estuaries would be useful.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Again, increased clarity on what can be measured would help seed ideas for innovative new technological solutions. Also, the production of data products (at least level 2) which offered geostationary timeseries of point / polygon and polyline data would aid the production of processing chains.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Set up funded, flagship programmes with private businesses, to meet specific business use-cases. These would be used to create templates for public-private partnerships in commercial geospatial data usage. The public data providers would be able to more effectively tune their offerings and the private business would receive improved data provision.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should be encouraged to develop business uses driven from the public sector data assets. Public sector providers have a duty to present the base products clearly and effectively, but added value products should be provided by the private sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

See answer to question 6 which also applies here.

Be careful with standards since they tend to be far too complex and written by standards people, not those who have to use them. INSPIRE and ISO19139 are two examples of this.

We are also hampered by licencing situations which are too complex.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Create a set of principles for everyone to follow without specifying their technical implementation. Keep standards simple.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

HR Wallingford is a water sector organisation and so we are always interested in areas such as drought and flooding on land, marine operations and hazards, coastal processes etc. Some of these might fit into infrastructure and construction, but also disaster risk and response; climate change impact.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	**[Text redacted]**
Organisation	**Health and Safety Executive**
Job title	**[Text redacted]**
Address	**[Text redacted]**
E-mail	**[Text redacted]**
Telephone	**[Text redacted]**

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Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The categories fit with the work we do at HSE. If we were to suggest any additions, it would be data that are not originally intended to be geospatial, but through analytical techniques such as fuzzy logic for matching with geospatial data (e.g. addresses), or text mining to extract geospatial references for unstructured text, can be mapped. This would fall into the third type.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The Geospatial Commission should consider a holistic view when determining its focus. This is to reflect the wide range of existing and emerging scientific research and engineering based skills relative to the following:

- Sensor design, sensor development, terrestrial survey, aerial survey, data capture, data collection, spatial data management, data dissemination, process automation, artificial intelligence, predictive modelling, cartography, hardware and infrastructure provision, visualisation and computer science.

A holistic approach should also ensure that such technical skills are not contained within individual silos.

Ensuring the role of geospatial within the developing fields of data science is also important. Where data are relied on more and more for decision-making by business or government, and where geography may be a key factor, it's essential that this is understood and accounted for effectively. This also applies to other sciences that crossover in to geography.

To ensure UK capability, the Geospatial Commission should work with trade and industry bodies, academia and professional institutes to agree and align professional standards / quality which are recognised internationally and do not prohibit or limit an individual's capability. E.g. our geospatial professionals should be world leading, respected globally and enabled to work internationally.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The skills needs and gaps are often on the peripheries of GIS, including database management, software development for geospatial applications (e.g. for web services and apps), data acquisition (e.g. web-scraping, mobile data capture, interfaces with data collectors/sensors etc.) and statistics/analytics. These skills are often hard to resource – this has been the case for software developers in our own organisation. These skills required are in demand in other areas, which often pay more.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Company and company location information (e.g. headquarters and different operational sites) is very valuable to us for understanding where workplaces are and how they're connected, to support HSE's role in workplace regulation. This requires an understanding of individual sites as well as at group levels. There are datasets that provide some of this information but nothing that provides the full picture.

Valuation Office Agency data used to be available as a national dataset, but is now only available on an individual record basis. It was an extremely valuable source of building and workplace information for us.

Local Authorities collect a lot of useful data but the barriers to access are difficult due to the large number of local authorities that would need to be contacted. Consistency is an issue for these data where standards are not in place. Similarly, NHS data are managed at trust level and only some of their data is collated nationally.

Other useful information is insurance/loss data for understanding costs of hazard events. This would provide much greater detail than we can get from our current sources.

Easier access to aerial photography and hi-res terrain data, including licensing similar to PSMA, covering commercial use etc.

Easier ways of sharing data between regulators. Currently this is not always straightforward due to licence issues, data protection, and awareness of data that might be available.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Data are not always complete. Current data standards for addressing (BS7666) don't cover all of the information that we are interested in, for example address/building classification data are valuable but is not consistent across the dataset. This is due to the way that the data are captured at the local level. Increasing the stringency of the standard would help to address this.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Ensuring a thriving R&D arena exists and providing adequate support to facilitate emerging / novel techniques / technologies are brought to market swiftly and timely.

The Geospatial commission needs to have a good understanding of where UK is an exemplar and also identify where the gaps are.

Support should be available to exploit niche areas.

Ensuring that EO data are widely available, used and not just left sitting in data centres. This may require removal of barriers to access.

Guidance should also be investigated for best practice and longevity of EO data.

Understanding and demonstrating the added value that EO data can provide.

From an archival perspective the commission should provide some steer on ensuring existing EO data are handled for future generations.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

A plethora of low cost sensors have become available on their own or embedded into industrial devices and consumer products (smart devices such as smartphones and wearables), providing new opportunities to collect a wide range of data including: driver behaviour at the wheel, logistics efficiency, individual physical activity levels, heart rate, wellbeing, fatigue, stress levels, environmental pollution (urban air, noise..) and so on. In all these applications, spatial information brings an additional dimension to the data collected. Both asset and personal positioning and navigation technologies (GPS, Wi-Fi, Bluetooth…) need to be further supported in order to provide commercial and economic benefits.

Internet of things, asset and fleet management, smart city infrastructure (e.g. street-side counters) and sensors - geography may be the common attribute used to link these.

Big data technologies and tools may be required to handle this scale of data.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications need to be available to those developing and/or using applications delivered through the use of smart devices. This includes background mapping, geo-spatial databases of relevant information (routing, infrastructure etc.). This will help to support technology such as tracking of objects, AI (inc. predictive modelling, automated decision-making), driverless/pilotless vehicles (inc. cars and drones), real-time automated mapping from wireless sensors, technology for optimisation of resources

Where technology that depends on geospatial is used for decision-making or creating efficiencies, it is essential that they have access to up-to-date data. This will both improve the quality of the technological uses, and ensure that elements such as health and safety are properly considered.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Options include:

Working in partnership with private and other third party stakeholders.

Incentives (e.g. grants) for individual organisations to collect, manage and provide data that has been developed for their own interests.

Outsourcing geospatial data assets (subject to appropriate security classification) so that commercial operators can help maintain, and also benefit from geospatial data.

Creation of a National Spatial Data Infrastructure through combined and shared contribution of existing data.

More sharing of data and expertise to unlock value that may be held currently within individual organisations. This may help to identify efficiencies in data management through re-use of resources, etc.

Innovations in licensing and cost models (e.g. subscriptions).

Extension of the PSMA, or other central funding to support data maintenance, so that more data can be made freely available.

Investment in a platform for sharing data. Data.gov.uk exists but can be difficult to use both as an uploader and downloader of data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

There could be a priority for personal positioning technologies for indoor and outdoor usage that could be implemented on Internet of Things devices and wearables.

Improvements on spatial accuracy of all existing positioning technologies. Can we get any better, go further?

Develop standards for indoor positioning systems

It is a priority for public sector organisations to have an understanding of the developments happening in the private sector, to ensure that areas such as response, regulation and policy are up-to-date.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector plays a key role in maintaining underlying infrastructure that is critical for our work. It would be useful to build collaborations with private enterprise to make the most of the wealth of public sector data and private investment. This could be a core driver in developing new tools and improving public services. HSE has a long tradition of working with industry to prevent illness, injury and death in Britain's workplaces. It would be useful for us to be able to extend the capacity for public-private collaboration.

It would be useful to improve sharing of private-public national infrastructure data relating to regulation, or is of government interest from a public safety perspective.

If current government geospatial capabilities were to move to the private sector, quality and access to the data should be maintained.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Application of OGC standards to current file formats provided by GIS software providers, would reduce time and costs associated with processing data from one format to another. The file formats used need to be those that are supported by GIS applications, so that data conversion is not required. These standards should also be secure so as to allow it to pass seamlessly through IT security systems / platforms.

Similar to Q9 - data.gov.uk could be improved to provide better access to data.

Easier access of data released as APIs, and WMS/WFS. These formats can be a barrier to access, both in terms of the skills required (which may not be part of people's skillset, particularly where geospatial is not a central part of a role), and the IT infrastructure at an organisation (which can limit some forms of access).

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Central liaison body providing contract negotiations for the public sector with third party geospatial organisations.

Determining standardised terms of reference for licensing agreements between geospatial partners. Provide guidance and arbitration.

Ensure that the geospatial data are of high quality, fit for purpose intended, provided in a timely fashion and are accessible.

Act as an entity to provide assistance with new areas of geospatial research.

Identify / set appropriate, realistic evidenced based requirements for geospatial data, applications and tools for the public sector.

Be aware of user requirements, at strategic and technical levels.

Horizon scanning of future trends in geospatial and related areas.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Data derived from mobile phones have massive potential for understanding people, their actions, and movements. This could be extremely valuable to us for risk assessment purposes, or scenario planning. However, our experience is that there are barriers in accessing this for both commercial and technical reasons (e.g. the data are not formatted geospatially by default). Given that mobile phones have been in general use by the public for over 20 years now it is surprising how few examples of its use in supporting the public sector there are. This may require agreement on a batch of derived datasets that provide sufficient protection to the original data (based on existing data protection regulations) whilst providing a range of useful outputs to users.

Similarly, new tech companies such as Google or Uber collect vast amounts of geospatial data for their commercial activity that is unlikely to be available to the public sector, but could have similar benefits.

Access to geospatial datasets from insurance / risk industries would have benefits for assessing the impacts of events, for example storms and floods. Current assessments are typically based on post-event surveys or media which are not complete, or objective.

Access might include direct data access in real time or near real time through API's

Partnerships developed through cross-organisation working groups (e.g. Natural Hazards Partnership, Regulatory Intelligence Hub working group, Data Science community of interest) help form collaborations between organisations, including sharing of geospatial data and methodologies. The Geospatial commission could facilitate working groups to come together to share approaches and data.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

From a central government perspective, local authorities hold a lot of detailed local data that could benefit national projects. However, quality and format of data are diverse and therefore difficult to use. For example, Ordnance Survey AddressBase data are created from data collected by local authorities. However, the rigour of classification differs between boundaries. Other examples can be drawn from household surveys, site inspections, land cover maps etc. This leads to challenges when trying to filter addresses for specific functional types. Development of unifying guidance on the creation and storage of such data would be of benefit to any organisation wishing to use the data at a regional or national scale. In many cases, adoption of Open Geospatial Consortium (OGC) standards would be a good start.

Access to data has been a traditional barrier between national organisations and local authorities. While it may be relatively easy to arrange access to a single authorities' data, if data are needed for a national project, the prospect of contacting over 300 local authorities and arranging data sharing agreements and file access are just not feasible. In such cases, it would be of huge benefit to have appropriate data accessible from a single point. This could be a central data warehouse for local authority data, where non-sensitive data can be stored and accessed with a common licence and common rights. This would open up the vast wealth of local authority data, making it more useable, more useful and more used. The owner of this data warehouse would need to hold a position in central governance across the UK and a technical solution would need to be designed, built and maintained.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

HSE's focus is on health and safety in the workplace so we would welcome any development that would help us in our national tasks. Information on workplaces, including those related to infrastructure and construction would be particularly useful.

The ease of incorporation of health and safety considerations within new technology and applications is also something that we are interested in. This includes technology such as BIM and personal positioning systems.

Q17: Are there any other areas that we should look at as a priority?

An emerging theme that has arisen from our current collaborative work in the Natural Hazards Partnership (NHP) has been the requirement for single common sources of data. For example, a single dataset representing the national road network, or UK population. This would allow easier comparison and integration of models built across the public sector and ensure that measurements relating to traffic/health etc. are based on common datasets.

Workplace health and safety are key concerns to HSE. Geospatial information holds an importance in this sector from the location and tracking of individuals within a building or place of work, up to regional and national impact assessments based on industrial accidents. This work contributes to reducing fatalities, injuries and illness at work and related to work activities. Further, the UK model of workplace health and safety is being sold internationally due to our outstanding historical records.

Regulation is another key concern for HSE. Geospatial information is being used alongside complex data science algorithms to produce data-driven approaches to site inspections. This improves efficiency and allows organisations to more effectively target underperforming (or dangerous) business and sites. This is providing successful and popular across government as it makes the most of existing data and methods.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

For health and safety and geospatial, we anticipate innovation occurring in the way inspections and investigations are carried out. Efficiencies in these areas can be realised with access to up-to-date data, using mobile devices, and with the capability to communicate information directly with administrators and analysts working back in the office. Geospatially, this may include live routing information and logging of spatial locations of evidence.

Access to inexpensive sensors has the potential to provide information on high risk industries and workplaces which could highlight risks to workers in novel ways. Such sensors may rely on positioning systems (indoor and outdoor) and high resolution mapping data (or BIM) to be effective.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

The UK has a long tradition in the collection and handling of spatial information. The UK is rich in such data, and with its commitment to Open, should be seen as a leader in data management and usage. Consequently, the UK could make its presence more visible in the international geospatial sector by presenting and sharing best practise. As the technology and data landscape changes and develops, the UK should strive to adapt its geospatial approach to keep pace with the change.

The UK could also be more proactive in improving the geospatial assets of other countries that have less resource for managing geospatial information.

This may be useful where national comparisons are required. For example, ensuring each country has the same framework for building population estimates would improve benchmarking of post-emergency loss statistics. This is directly relevant to the 2015 UNISDR SENDAI framework for disaster risk reduction.

This could include contribution to international standards committees, to develop international Standards based on the strengths of current British Standards.

Funded opportunities for secondments internationally (academia/workplace).

Encourage and support collaboration internationally, and maintaining links with EU countries after Brexit.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Our awareness of how other countries approach geospatial is limited, due to our national focus. We are often in a position where we are sharing our expertise internationally but this is often to share our own best practice rather than learn from others.

Thank you for your time in completing your response to our call for evidence.
Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Hydrographic Society UK
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**Professional Society**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The terminology differs from our normal usage, where we are primarily locating features and their attributes in the physical environment, but the groups seem reasonable.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Promoting the sector overall, to build public understanding, use and access to data, professional status and future careers.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The hydrographic industry is moving towards machine learning and other automated systems, as well as autonomous platforms. In the future, people within the industry will need these skills, as well as a more general geospatial awareness, to use many differing data types simultaneously.

As for promoting geospatial careers, there are established systems within schools to promote certain career types – these can be exploited. However, a combined approach from across the sector will work best, as careers promotion within schools is already a congested space.

A useful approach would be the development of unified online/digital resource packs which would be made available to teachers/careers advisory services, as well as students interested in exploring their geospatial career options more fully in their own time.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There is a general shortage of good quality seabed mapping and oceanographic data within the UK (and Overseas Territories). There is a need for cohesive 4-D (including time) geospatial data from the coastal zone out to the 200 NM (EEZ) limit.

Data that the government has collected is made available for free at a reasonable resolution, but there are many areas where data exists but is not shared. For example, the oil and gas and offshore renewables sectors.

Some nationsmake it a condition that all surveys within their EEZ are supplied to the State. This approach should also be taken with the UK.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

More precise encoding of address data will be required in the very near future to improve logistics. For example, a unique code for every address would be easy to enact by adding one more character to the current post code system.

As for evidence – ask any courier!

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Currently, the UK Hydrographic Office has access to worldwide EO data within the marine and coastal environment but, apparently, lacks the resources to harvest and utilise this data for change detection etc.

The UKHO's remit in this regard needs to be strengthened and supported to enable it to become a Maritime Geospatial Intelligence Agency (as per it current strategy). Also, its current funding model needs to be supported to move it away from its predominantly isolated commercial focus as much of this data will not deliver an immediate commercial benefit to the UKHO, but it may enable others.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

In the marine environment a broad spectrum of tools and datasets are required. Of prime importance is the understanding and integration of all these data types to create products and inform multiple end users.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Increased automation of data processing and validation using technologies such as machine learning and AI. Datasets, sensors and user demands are continuingly increasing in resolution. Although human design, expertise and intervention are still critical, key organisations cannot keep pace by relying on traditional approaches.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

In the marine sector, the UKHO has become somewhat diverted away from its core public task by being forced to make a direct profit from its products and services portfolio. Frequently, far greater revenues would be realised (and risks reduced) if it could more clearly follow its public task, with appropriate direct financial support from government.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Many marine applications need very precise positioning – including height. This is available at the coast by using Ordnance Survey CORS (either real-time or post-processed). However, further offshore very expensive commercial networks must be used. Improving the availability of high-precision GNSS offshore, combined with improved datum models, would reduce operating costs and increase inter-compatibility of data.

The UKHO's Vertical Offshore Reference Frame (VORF) model is a key component of this. However, despite a large amount of work (and Government funding through DfT) being invested in collecting data that could improve the model, the UKHO has not yet invested the relatively small sums required to reiterate the model and make it available to all marine users. This is another example of the UKHO's commercial model subverting its public task obligations.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector can provide applications and hardware to the market, but some of the key requirements and information required is held by government organisations. Greater efforts to work in tandem are essential.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Marine data from the public sector is currently made available, in a rather clunky and cumbersome way, via a number of separate web-portals. Investment should be made to coalesce these in one location, thereby enabling all the data for a geographical location to be examined and shared by multiple users.

The UKHO's vision to do this could be achieved, but not without considerable direct funding from government.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By ensuring data discovery, accessibility and efficient delivery to the end users, and ensuring that Government Agencies are not able to withhold useful datasets for their own commercial reasons (but are appropriately compensated).

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Yes. The Royal Navy (working in tandem with the USA) has very significant data holdings (primarily bathymetry) over massive areas of ocean. This data is all kept from public view because it was collected to support submarine operations. However, owing to the available coverage, it should be possible to desensitise it and make this data available to all.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

For the marine sector, ensure all data sources are shared. This includes private sector organisations, such as oil and gas and offshore renewables.

By using all data sources, almost complete coverage of UK waters could be achieved. Everyone contributes, and everyone benefits.

The same argumetns also apply (for much of this response) to the UK Oversea Territories.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

In the marine sector, better national coordination and standards are required. The Channel Coastal Observatory is an excellent example of this working in practice.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Once again, in the marine sector, the first stage is bringing all available data together in one cohesive shared environment to assist this analysis.

Q18: Are there any other areas that we should look at as a priority?

Legislation to require all marine (and terrestrial) data collectors and holders to share data centrally with government, who then provide access to all.

Also, increased investment in the marine sector for government-funded data collection programmes.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous and unmanned vehicles (including maritime surface, underwater and seabed crawling vehicles and coastal and terrestrial aerial vehicles and drones): legislation, operational safety and management and navigation.

Sustainable resource exploitation.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Invest in research and development of new data and products, as well as the UK Government Agencies who are the custodians.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In the marine sector, NOAA (in the USA). NOAA invests in data and product R+D, and already has a world-leading hub connected to a leading university.

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Hyndburn Borough Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	X
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission could liaise with the Education minister to make sure that geography taught in schools has an emphasis on the skills required to use GIS and the importance of maps.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There needs to be a better pay grade associated with GIS skills in the public sector. At the moment the skills are not recognised with the pay grade and GIS is not regarded as an important job within the authority. Public sector specifically designed GIS training courses should be organised to ensure current public sector staff keep up to date with the necessary skills to carry out their jobs.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The DVLA would benefit from using spatial datasets and be more willing to share information spatially with local authorities. Address Base should be available to the public but with the UPRN removed from the dataset. Ordnance survey Points of Interest dataset should be made available to local authorities so that councils can proved better services to the public.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The work local authorities do in respect of the street naming and numbering and updating the product called Address Base is vital to the utility companies, emergency services and public bodies. The release of part of the data for specific tasks/projects but not full access of dataset to the wider community.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

There is a need to provide better access to data.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Invest in new technology to improve mapping data. Looking at data storage and ability to use less storage but have the same quality of data.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

There is a lot of spatial data held by the public sector and the sharing of the data will grow the use of spatial data.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The public sector could maintain same datasets as long as datasets are shared and other agencies contribute to information to make the datasets more valuable.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

There is a need to include GPS as a priority as this is necessary for the public sector, emergency services.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector needs to give something back instead of putting profit first. The private sector needs to share spatial data with the public sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

More clearer instructions on installing the data is preferred to make it easier and quicker to install on file servers.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The geospatial commission should communicate with its audience the public sector to find out their views and understanding. Clearer communication.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Points of Interest from Ordnance Survey would be beneficial to the local authority in order to provide a better customer service.

Land Registry map search and title download should be made available free to local authorities to enable a more efficient service and would enable local authority to recover costs spent on making dangerous buildings safe.

Aerial photography at a better scale to aid possible unauthorised building works.

Water Network layer should be made available free of charge to the public sector as it would help when dealing with enquiries and complaints from members of the public.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

There needs to be regional variations to the strategy.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Hold regular workshops/discussions and communication by email.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Address Base could be improved.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

DVLA information would be a valuable asset.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Promote the spatial data more widely.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Probably Germany and the Netherlands has a strong use of spatial data.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	IIC Technologies
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definition of "geospatial data" is concise and reflects many of the definitions in current use (particularly the ISO TC211 definition and the OGC definition) where location is an essential "property" of the data so, whilst a "new" definition of geospatial data is probably not required, the one that has been defined is at least in line with existing best practice within the global geospatial industry.

"positional data" may conflict with other geospatial data types already used extensively in the industry. "Positional data" tends to refer to data where the predominant component is the position itself (and almost implies a temporal component as well). We would advise searching for another term to express the "secondary" nature of the location within this data and possibly reinforcing it with examples to illustrate the concept.

"geospatial identifiers" would benefit from clarity over whether identifiers are (a) unique and (b) persistent (particularly as expressed between scales by authorities). This is not to say all identifiers must be unique and persistent but they are such essential facets of the concept they warrant documentation within the definition.

Overall the definitions provide a good foundation but would benefit from additional context and scope for the commission itself which is not supplied as part of the charter. Does the commission and its activities only apply to "UK activities"? How does it relate to Crown Dependencies and Overseas Territories (including the Isle

of Man and the Channel Islands)? And is it activities of the UK agencies as far as they relate purely to the UK or globally? There are good, searching questions about global activities (and regional / local authority activities) but an overall "scope" statement of the activities of the commission and its component parts would really help put some parts of it in focus (this is particularly important in a marine context).

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Skill and educational needs should fully encompass a wide variety of training in broad geospatial principles and science and be based on a vendor-neutral approach to learning (fully encompassing open standards as well as skills with proprietary tools as well). It should emphasise strong interfaces with the related disciplines of Computer Science and Mathematics and allied disciplines such as cartography and design. The use of standards should be a foundation for a geospatial curriculum including working with regional partners (e.g EU, INSPIRE, UN-GGIM) and international standards bodies such as ISO, OGC and IHO

It should also focus on demonstrating that geospatial skills are constantly evolving and that emerging fields such as geospatial data science such as machine learning in a geospatial context and the semantic web community will be key skills in the future.

Skills and Education should have a component of access to current research and development and active investment in key research areas.

There should be access to harmonised simple models and data for the UK extent for educational purposes.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Education in marine data sciences is under represented (particularily surveying, cartography, and in the processing/analysis of marine geospatial data). It would be good to have potential students exposed to this field early, with opportunities to pursue learning and research in it.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Interoperability and integration between data from different providers is a major themes. This should include :

- objective quality measures through harmonised metadata (including those between scales).
- Uniform, persistent identifiers across all sectors
- Single licence for UK geospatial data from all agencies for simple purposes.
- Easy access to data for commercial exploitation and resale.
- Access to EU data through agreement.
- Access via open standards

Interoperability of models for data across different domains (e.g terrestrial and marine) core strength of the UKs data holdings.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address should be looked at in a wider context as part of a hierarchy of location technologies, some of which are emerging. The ability to compute very large sets of locations with big data technologies could unlock a lot of value and addressing/postcodes is a grouping of location data with a major importance.

Addressing is a complex field with many facets though and standardising and ensuring the quality of the data is of the utmost priority. UK needs an objective statement of how addressing works (and scope bearing in mind response to Q1), how it relates to global addressing models (including the EU). The aim should be to have a standardised, high quality, maintained model as integrated with regional partners as possible.

A thorough and far-reaching review of the financial benefits of the current licencing scheme for postcodes / addresses should be carried out to see if the £1.8bn of value (estimated by Deloittes in 2014) is being realised by the licenced partners. This should be part of a larger review of how cost-effective the current charges and restrictions are.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK should adopt wide ranging and ambitious goals of providing EO data into the open for exploitation including for commercial purposes. The marine environment must not be forgotten in this area. The aim should be to provide the maximum amount of well documented, standardised and high quality EO data to both partner organisations (inter-agency in the UK) and external value-add partners. Data should be at the highest resolution possible to encourage maximum potential for adding value in its processing. UK should benchmark itself against other global leaders in this field and ensure access to EO data for UK stakeholders. There should be a presumption of openness and access via simple licencing models where cost-recovery is required.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

New technologies should go hand in hand with development and adoption of new standards and be built for interoperability nationally, regionally and globally. It is of vital importance for government to provide a stable base for innovation. Some suggestions:

- Establishment of national geospatial registries to provide harmonised definitions between domains and to drive intenlligent metadata
- Geospatial semantic web standards
- Geospatial data science and machine learning centres of research and excellence in conjunction with large scale geoprocessing and analytics
- Geospatial applications within blockchain based instrastructures
- Look at the OGC's emerging trends movement for identification of actual areas to encourage. These have been identified by the entire geospatial industry. https://github.com/opengeospatial/OGC-Technology-Trends
- The W3C/OGC Spatial data on the Web working group have a good set of best practice gathered from many stakeholders across the geospatial community.

Don't forget Marine!

- Smart Ports
- Tides - erosion
- Storm Surge prediction
- Land / Sea integration across the inter-tidal zone.
- Marine Spatial Planning and integration of marine with terrestrial cadastral systems
- Fishingm, pollution monitoring
- Common models for data with good dividing lines to outlaw duplication.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data has a key role to play in decision making systems such as autonomous transport but requires high precision / high volume data sourced from a new generation fo data capture devices in conjunction with an infrastructure capable of supporting it.

A national spatial data infrastructure, encompassing both marine and terrestrial should be borne out of a review of current assets. This infrastructure should take the "old" SDI concepts and update them for the modern context pointed to by UNGGIM's reformulation of global goals.

The national SDI should promote roll-outs of future technologies by enabling re-use and multiple purposes of spatial data including structures which enable machine learning.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Adopt and invest in initiatives which promote the principle of interoperability through standards as a foundation for innovation
- Invest in data discovery and promulgation infrastructure
- Public sector organisations are the “authority” which defines officially where (and what) things are. This should be the guiding principle in the maintenance of the national infrastructure and therefore clarity is the most valuable commodity the public sector have. Overlapping responsibilities and data conflicts should be eliminated from the national geospatial infrastructure.
- Public sector organisations should offer both raw measurements and more refined products/services where they enable innovation and added-value products and services. Offerings should be in as wide a variety of open standards as possible with sound, reasoned and open judgements on format, content, metadata, update, provenance, processing, distribution, price/licencing structures.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- Unified datums (particularly) between land and sea.
- Clear and non-conflicted data domains nationally
- Efficient open standards
- Harmonised / unified data models between domains
- Digital, legally provable provenance over all public sector data
- National harmonisation of all geospatial data, regional and global harmonisation through best practices and intelligent use of open standards.
- UK should lead through investment in innovation the next generation of spatial infrastructure globally.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The Private Sector should be encouraged through partnerships to contribute to an emerging infrastructure which makes the UK a pre-eminent SDI globally. Private sector talent in this industry is huge and public sector should be looking to enable it both for its own infrastructure and in order to build private sector enterprises capable of selling capabilities and skills to the rest of the world. This would mean adopting, funding, investing in a range of capabilities and measuring their success by the value they generate for UK plc. The UK's data assets are likely to be curated by the stakeholder bodies for many years, like other states, but private sector involvement should be sought to push research forward and evolve geospatial infrastructure to the next level.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Non-harmonised data models
- Harmonisation with European neighbours / region and transfer of technologies and solutions to/from UK.
- Difference of purpose, mission and goals between organisations, mainly as a result of different funding models / missions and overlapping missions.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- By mandating open standards for content and exchange and best practices for building national infrastructure.
- Harmonised licencing, pricing and usage structure.
- Ensuring the various bodies are equipped to provide the very best in authoritative master data into the national infrastructure.
- Providing investment and clear dividing lines for commercial exploitation for data.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Marine data is not represented in the list given? Unlocking marine data for all UK agencies and providing a foundation which can be built on by private sector contribution through added-value is essential.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- Scope in terms of “UK” (overseas territories, devolved governments, overlaps and gaps) needs to be considered and defined precisely before strategy can be formulated.
- Strategies need to flow down from common UK national goals, adapted for individual geographies, jurisdictions and needs
- Needs to include marine domain as well as terrestrial in a harmonised fashion
- Fundamental is boundaries and limits / cadastral structures which harmonise with neighbours regionally.
- Clarity through standardisation and use of existing bodies of knowledge and best practice will build a foundation which can be tailored for all participants.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

By adopting a hierarchical strategy where all participants use a framework of standards, quality, management and infrastructure to produce and make available data across public services.

Unification of standards and interoperability between different silos would help enormously. Build on what is already built for this purpose though and publish/publicise what already exists before undertaking incremental evolution of geospatial assets with a unification end goal. Local authority coordination is best achieved by allowing the implementation of local spatial infrastructures which are interoperable with a national one and providing clear frameworks and best of breed tools to local authorities for their use.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Data to support autonomous transportation
- Investment to support better prediction of extreme weather events and their impact.
- Reduction in update turnaround for all national datasets.

Q18: Are there any other areas that we should look at as a priority?

The UN-GGIM sustainable development goals, the UK's implementation of them and alignment with neighbours in region on them should be a founding principle of the national geospatial infrastructure.

The marine sector must not be forgotten in the list of areas
E.g

- Movements, positioning and logistics in the shipping industry including smart port infrastructure and its links with national transport facilities
- Marine spatial planning and interaction with regional neighbours in north sea, channel, irish sea and beyond.
- Coastal / intertidal zone management with a focus on large scale definition of the intertidal zone and planning/exploitation investment.
- Establishment of a national spatial infrastructure to serve all high value initiatives.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- The OGC's list of new technologies, referenced earlier in this response is a really good list of candidate technolgoies.
- Innovations in machine learning, computer vision recognition, autonomous navigation will need high quality, dense geospatial data.
- Smart cities and ports
- A switch to realtime / streaming applications from static ones.
- Regulatory challenges are there but skills / expertise exists to solve them and, arguably, is a good thing for the public bodies to take on in partnership with innovators.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- By exporting skills and expertise to work on geospatial data engineering.
- Pioneering research in applied fields
- Leading technology, showing how benefit can be gained by state and private sector
- Investment in participation and formation of international partnerships and standards for interoperability.
- Participation at the leading edge of developments.
- Hosting of international meetings and fora to position UK as a hub of innovation.
- Public / private partnerships to support outreach internationally.
- Making the availability and associated use of data frictionless (i.e. simple or otherwise unrestrictive licensing, easy to discover/use, etc).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- Marine cadastre in European countries
- Learning from global standardisation efforts by international organisations ISO, OGC, IHO etc
- Use of public participation for crowdsourcing in many geospatial fiedls
- Regional, modern SDI/MSDI examples e.g Arctic SDI
- Looking at other states investment in their geospatial infrastructure.
- New Zealand (LINZ) and US (NOAA) are very good at encouraging easy access and use of data assets

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via

National Geospatial Strategy Call for Evidence
IMGeospatial
13th October 2018

IMGeospatial

IMGeospatial

Q1 – Is our view of the geospatial data types accurate, if not what should be included or excluded from this?
A1 - The current view of geospatial data sets is, in our opinion, accurate and does not require amendment at this stage.

Q2 – In addition to current government policy, what are the areas of geospatial skills where the commission could best focus to help ensure the necessary capability within the UK for the future?
A2 – The commission would be best focused towards the underlying technology and the development process, including the coding required for Earth Observation (EO) and Geospatial Information systems (GIS) solutions.

Q3 – What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?
A3 – The major gaps are in the development and business sales areas. By avoiding labelling the products "GIS" and instead encompassing it in "Business Intelligence", there will be a greater appreciation that GIS data is just another data input into the solutions.

Q4 – How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?
A4 – Free access to Ordnance Survey (OS) data and master maps for Non-Governmental Organisation (NGO), Small Medium Enterprise (SME) and Academic entities would increase its use and avoid organisations building their own georeferencing systems that would undermine the business case for OS products.

Q5 – Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.
A5- UPRN and UPSRN as well as INSPIRE data is invaluable for development of any geospatial product across the UK. The emerging technologies should have access to data and services they require to develop disruptive applications and businesses, rather than receiving direct economic support. This will create exports for UK plc.

Q6 – How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?
A6 - – Both EO and GIS should be part of the same solutions. If the correct tools are in place to enable the use of these data sets; e.g. cloud computing, data cubes and support; they allow businesses to develop innovate business solutions. The infrastructure for generation of Analysis-Ready Data (ARD) and what that actually means, as our ARD is different to manual processed ARD. UK Government and the commission should give access to Very High Resolution (VHR) Data, as well as lower resolution data to enable us to build and use it.

Q7 – Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial; data for economic growth?
A7 – The commission should focus on disruptive technologies such as IMGeospatial and AIMEE.

Q8 – How can geospatial data and applications be used to support enhances roll-out of future technologies?
A8 - Geospatial data is part of the data inputs required for disruptive innovations.

Q9 – What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?
A9 – There are areas where outsourcing to business can drive innovation and could increase efficiencies. OS is not a natural innovator of disruptive technology and could be left behind in the next 10 years as the development of technology accelerates. A tender process for each part of the business would avoid this scenario.
Brexit opens the opportunity to develop UK Plc and can utilise the technology and skills to develop a world leading eco system of EO/GIS/Business intelligence and disruptive innovation. 25% of all government contracts should be given to SMEs, with funds to drive innovation toward clear outcomes in a similar way Innovate UK helps grow ideas into businesses.

Q10 – What areas of the underpinning geospatial Infrastructure such as position technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?
A10 –GPS or GNSS give the greatest opportunities to enable the development of smart cities and Autonomous Vehicles (AV). With all the large car companies investing $Billions into this area over the next 5 years, if we're not on the boat we'll miss this next revolution.

Q11 – What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?
A11 – As with Q9, a funding structure to fund Innovation within UK Plc is required.

Q12 – Do you have challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.
A12 – PAL – INSPIRE – UPRN needs to be in one dataset, ARD standards for EO data need to be turned into Machine Learning/Artificial Intelligence/AIMEE usable data. This would reduce the need for workflows and let companies focus on the parts they actually need to innovate. ARD standards would ensure all innovative systems would be interoperable and would ease scaling for UK Plc

Q13 – How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?
A13 - – The priority is to act as an aggregator for all Public bodies to allow economies of scale when purchasing, although this could potentially damage SMEs who earn out of resale. However, driving innovation and being the link between innovation and the public bodies would a strong role for the Commission. Having finances to spend on driving innovation and helping SMEs develop their ideas, rather than on data, would create products that could be exported globally. Around 25% of all government contracts in this space should be given to SMEs

Q14 – Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?
A14 - Having access to all tools like IMGeospatial AIMEE to extract data over scale and creating the outputs for all geospatial products. EO data and testbed data to enable us to do PoC over large scale would assist innovation.

Q15 – How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?
A15 - Strong communication between individual strategists and a common platform would address this.

Q16 – How can we best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?
A16 - Downward dissemination of information and products through forums, meetings and seminars would allow LAs to have direct contact with SME solution providers. An Innovate UK style environment, where SMEs and LAs can access funds to develop solutions would be a very positive step forward.

Q17 – As a result of this analysis we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **Property and land**
- **Infrastructure and construction**
- **Mobility**
- **Natural resources**
- **Sales and marketing**

What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)
A17 - Mobility and 5G are the areas of largest interest. However, water resilience is a major issue, whether flooding, drought, supply or disposal, there is a need for geospatial data. This is key to unlocking and ensuring resilience into 2050. If geospatial data is used in near real time it can reduce the need for infrastructure projects, instead

utilising natural catchment management systems and helping the whole country smooth off the peaks and troughs which cause so much chaos and cost to UK Plc. It has become the norm to develop narrow engineering solutions to what is an environmental problem. A new 'evolving' DTM needs to be generated to help the EA make proper decisions with forecasts not looking historically to what has happened historically.

Water is an essential component of all civilisation. This should be the priority and solving current issues would develop many new technologies and stacks which could be exported and sold around the world.

Q18 – Are there any other areas that we should look at as a priority?
A18 – The response to Q17 has highlighted the need to look at water and other critical environmental issues.

Q19 - What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulator challenges?
A19 – Autonomous Vehicles, Drones, Flooding and water resilience, smart cities.

Q20 – How best can we make the UK's presence in the international geospatial world more visible?
A20– There should be an scaled and concerted effort to bring all interested parties together to grow the business sector. In addition, the process should go beyond the UK and look to engage with overseas customers and partners. Not just OS but using OS as a tier 1 contractor and with the Environment Agency and selling UK Plc to the world Bringing SMEs into the limelight.

Q21 – Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?
A21– Australia is a key area where we can learn a great deal about the use and implementation of innovative technologies in this sector.

Geospatial Commission: Call for Evidence Response Questionnaire

Please submit your completed questionnaire to:
geospatialcommission@cabinetoffice.gov.uk.
Clearly title your email *'Call for evidence response'*.

About you and your organisation

Organisations	Improvement Service, Manchester GeoMatics / Liverpool University, LandInform Ltd
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Local government	**X**
Commercial/Consultancy	**X**
Academia	**X**

Authors:

[Text redacted]

GeoSpatial Commission – Call for Evidence

Question 5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies?

Overview/Background

On the face of it, addressing should be simple. Everyone (with a few exceptions) knows where they live i.e. their home address. However, it is a far more complex subject than this, and involves referencing property other than dwellings, as well as the ability to reference other "addressable objects" the scope of which is almost unlimited. Addresses provide the linkage between a wide range of datasets and to various geographies. Commercially available address files are also core business dataset for over 40,000 UK businesses. As such, it is an extremely valuable dataset, and a vital component of our national data infrastructure. However, over the last thirty years the ownership, custodianship and maintenance of national address files has been the cause of much bitter argument and dispute.

The issue at the core of this argument is the economic status of address data. The Universal Postal Union in their White Paper "Addressing the World – An Address for everyone" emphasises the importance of addressing, delivered as a public good, for civil society. By contrast address data sets in the United Kingdom have been considered, owned, marketed and had their IP protected because address data is treated primarily as "tradable information". This conflicts with the mission statement of the Association for Geographic Information, which is "To maximize the use of geographic information for the benefit of the citizen, good governance and commerce.

We believe that that is most likely to be achieved in the case of address information if a sustainably funded mechanism can be found to make it a public good. We believe that treating address data as "tradable information" reduces use because of cost and licensing barriers, creates wasteful duplication of efforts and reduces the quality of address information because of commercial confidentiality. Moving from addressing as @tradable information@ to address data as a public good will be one of the largest challenges for the GeoSpatial Commission.

Addressing has a key role in all five themes of public sector use cases (Housing Land and Planning, Security Emergency Planning and Response, Transport and Logistics, Environment and particularly Citizen Engagement and Service Delivery) as identified in the *"An Initial Analysis of the Potential Geospatial Economic Opportunity"* document.

The Geospatial Commission provides a unique opportunity to resolve the underlying controversies and in doing so, open the way to underpinning many of the published benefits that the Commission is tasked with delivering, also described in the above referenced document.

Digital Addressing for a Digital Future

In the call for evidence the Commission has correctly identified addressing as a key part of the geospatial data infrastructure to support our future digital economy and state that *"Address data is one example of where it could be economically valuable to take a more collaborative and systematic approach to aligning interests to support access to data."*

This paper provides a response to Question 5 and identifies both changes needed to address data and the wider address ecosystem to support future technology needs and opportunities as well as a suggested proposal to move forwards.

Significant progress has been achieved since the founding of GeoPlace seven years ago. This has enabled business collaboration between local government and Ordnance Survey to create an enhanced National Address Gazetteer (NAG) for Great Britain which integrates additional postal addresses from Royal Mail and property addresses from the Valuation Office Agency.

Partly because of this progress, attention has shifted in some quarters to argue for addresses as Open Data. However, while these calls for open addresses should be recognised and supported, the drive for open addresses must not distract from the key focus on maintaining and improving quality of national addressing. If the outstanding and fundamental issues around process, content and licensing can be resolved, then the release of an open address dataset could be enabled as a by-product.

There is a still much to do to reach the quality levels required to ensure the National Address Gazetteer is definitive and future proofed. Addresses need be more than just postal addresses – they must be able to connect us to the digital world.

The National Address Gazetteer delivers all the basic elements required for a digital address. It is consistent with the British Standard for addresses (BS7666) and, as well as a consistent and structured natural language description of the address. This provides a standard identifier, known as the Unique Property Reference Number (UPRN) and a National Grid coordinate for each address. At the time of writing these are subject to a proposal from the Open Master Map Steering Group to release these as open identifiers under an Open Government Licence. The National Address Gazetteer provides the basis for interlinking and precision to support future location-based services. It also provides a

classification of the address and a record of its state allowing control over content and process for address management, maintenance and supply.

It is argued that to complete the development of a definitive and future proofed National Address Gazetteer, there are several key issues remaining to be solved.

1. The current licensing of address data is complex, it limits a rational approach to national address data management and ultimately deters widespread use. A new approach is essential and is the key that will unlock the potential of digital addressing for a future digital world.

2. There is unnecessary inefficiency and duplication of effort in current national address data creation and management processes. Local Government, Ordnance Survey (GeoPlace), VOA, HMLR and Royal Mail all maintain national address datasets, either as part of the National Address Gazetteer data management hub or else independently. A greater alignment of address data creation and management, along with a central address data clearing house and hub, is required to improve quality and content and deliver real-time updates. New approaches that deploy advances in machine learning and AI to overcome the limitations of current data matching and integration need to be developed.

3. The greatest impediment to progress with addressing are the financial interests of those involved which have tended to reinforce the status quo and limited innovation in delivering a joined-up national address infrastructure. Published figures show that in the last financial year Ordnance Survey provided GeoPlace with £13M of funding and this led to a reported profit of around £7M. Royal Mail realised £32M of revenue from PAF, returning a profit of £5M. The published costs of maintaining addresses by the two organisations was £6M for GeoPlace and £27M for Royal Mail. Local Government, recognised as being the creator of addressing, incurs costs in the order of £15M (c400 gazetteer custodians @£30k plus system costs) and also contributes licence fees to OS and Royal Mail in respect of addressing products, which are based largely upon its own information. While these numbers may appear large, they are no more than noise, if the Boston Consulting Group's view that £ 11.5 billion of benefit could be released if geospatial data was more fully used. For example, is it right that relatively small profits should prevent address data from appearing attached to individual buildings on OS mapping, Google Maps, Open Street Map and other sources widely used by the public. Other countries, such as Australia do not limit the use of addresses in this way. Similarly, the HMLR INSPIRE index polygons would be very much more useful if they were referenced with an address or UPRN and not an arbitrary identifier. It is in the field of addresses that current practice leads consistently to data use prevention, rather than maximising benefit to citizen

4. The current focus of addressing is on property. This approach needs to be extended to encompass land and property to support the digital land agenda and a more comprehensive set of entities to support digital delivery of services. Precision addressing of buildings and infrastructure is required to support emerging technologies at the interface between the Internet of Things (IoT) and Smart Cities. An ecosystem approach to addressing buildings is required to reflect and resolve their complex use, occupancy and behaviour.

5. Addresses usually refer to a dwelling or business premises. However, BS7666 allows for the concept of “addressable objects” other than buildings, premises or land parcels – the focus of a National Land and Property Gazetteer. This raises the question of what else can, and needs to be, addressed. Different address custodians respond to local need or preference by addressing all sorts of objects such as horse troughs, or ATMs. This raises the interesting question of whether an address is still an address if you don’t know what you are addressing. This isn’t merely a philosophical point but is fundamental to address quality. If you can’t enumerate the objects you need to address how do you know if you have addressed them all, or what proportion of them you have addressed. The Office for National Statistics has this problem when it needs a definitive, and complete, list of dwellings in order to count how many people live there. The Cabinet Office Government Digital Service considered at one stage producing a National Address Register as part of their general work on registers. Registers were seen as definitive lists of well specified objects such as vehicles, companies or taxable hereditaments. The advantage of a register is that the type of object that it lists is strictly defined in its terms of reference. Addresses are almost certainly the most common identifier used to geographically reference other registers. However, the idea of an address register in itself is probably not helpful, unless it conflates all the addresses used in other registers. The Postcode Address File is, in fact, a register of postal delivery points. The starting point for the NLPG is that it is a register of all taxable hereditaments. Other registers such as the register of Energy Performance Certificates, have found current addressing restrictive because buildings without an address may need an EPC. The utility companies need to tie metering points to addresses which, again, may not coincide with any existing register of addresses. So, it is our view, that when exploring national addressing, addresses should be treated fundamentally as a standard geographic identifier used in registers of well-defined addressable objects. However, to avoid duplication of effort, there should not be any commercial or IPR restrictions to the use of addresses over a range of registers.

Changes to address data and the wider address ecosystem: A Proposal

The existing arrangements around the maintenance of the national addressing asset are outdated having arisen out of historic responsibilities and the piecemeal and at times acrimonious, way in which the entire national addressing infrastructure has evolved. The Geospatial Commission Partner Bodies have worked together before, in different groupings and projects, on improving addressing - the National Land Information Service (NLIS), Project Acacia and the ODPM National Spatial Address Initiative (that led to the formation of Geoplace) and OS development of the AddressBase product range. Building on this experience, it is proposed that the Commission establish a formal sub-group to take the lead on a collaborative approach that promotes the realignment of interests and assets to build a single definitive and future proof National Address Gazetteer.

The following areas of investigation should be considered as the remit for a programme of work for the Geospatial Commission addressing sub-group.

- Review of the current and future requirements for addressing at the national level, considering extended content to support future digital applications across land and property, service delivery and precision addressing for buildings;

- Investigate addressing provision in other jurisdictions with focus on, but not limited to, Europe;
- Review the impact of potentially disruptive advances in addressing (e.g. what3words) and the increasing role of identifiers, noting the work undertaken on the UPRN/USRN.
- Review of the full land and property lifecycle to determine where changes and responsibilities occur which impact upon addressing;
- Propose a design, building upon an understanding of requirements and lifecycle process, for a central address data clearing house and hub for national address management, maintenance and supply that would realign the existing outdated approaches, reduce unnecessary inefficiencies and duplication of effort while allowing responsible bodies to continue to maintain address data, noting the document *"An Initial Analysis of the Potential Geospatial Economic Opportunity*" stresses the importance of *"Ensuring that interventions do not undermine the stable funding base of important national assets over the long-term";*
- Investigate and propose models for providing open access as a by-product of a realigned national address data maintenance and supply hub, with consideration of a minimum viable address data product for early release e.g. a national buildings data set with open address identifiers linked to MasterMap building footprints;
- Explore the use of addresses in government registers and any synergy that can be achieved by sharing address data.
- Consider how new technologies and innovations can be harnessed to increase opportunities for building a national address data ecosystem through automated AI data linkage and aggregation pipelines;
- Evaluate the future benefits of digital addressing, to enable alternative funding and revenue sharing models to be explored, that would support the realignment of existing business interests for those organisations engaged in address data creation and management;
- Examine whether it would be more advantageous to fund address maintenance custodianship and dissemination, though existing charges at the point where an address is created, changed or recorded, rather than charging for the use of address data.
- Support a programme of work, with full appraisal and analysis of costs and benefits and with an indicative roadmap, to remodel the arrangements under which addresses are created and maintained.

Conclusion

The Geospatial Commission provides the ideal opportunity to resolve the issues that have caused conflict over addressing for decades.

It is uncontroversial that address files constitute "core reference data" for many governmental, statistical and commercial operations. What is controversial is the issue of whether the beneficial use of address data can be maximised by continuing to treat it as "tradable information" in a very imperfect market which requires some degree of regulation to ensure that it is genuinely competitive. Or, whether there is a way in which address data can become a sustainably funded "public good".

We believe that there is a risk if address data was to be funded directly from the public purse, because of the very severe pressures on local and central government spending, therefore monies would have to be targeted at achieving clearly defined outputs. However, addresses are essential to maintain many public registers, where those registering information are reliant on reliable addressing and are

already paying a registration fee. Hypothecating a very small part of some of those fees would generate a sustainable flow of income to fund maintaining addresses as core reference data.

We would encourage the Geospatial commission to set up a specific project to deal with address data and to revisit some of these controversial issues to find a solution, drawing on international experience where appropriate, to what remains a barrier to the effective use of a core set of geospatial information.

Response to the Geospatial Commission's Call for Evidence

Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Incorvus Ltd.
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**
Other - please state	

“Give me a place to stand and I will measure the earth”

Incorvus is responding to the “Geospatial Commission’s Call for Evidence”. This response is informed by our depth of experience in successfully troubleshooting data, delivering systems for organisational intelligence and from observing public sector computing challenges over recent years. Our practitioners’ insight is derived from our Business Intelligence (BI) experience and our knowledge of data and governance disciplines. Time has proven the resilience of our solutions and advice and we maintain strong international links to keep our understanding current. This is what informs our response to this Call for Evidence.

This real-world perspective on information governance has led Incorvus to a data-centric approach, which we regard as essential for 21st century and big data systems: to realise data value and sustain reliable insight. Putting the data first provides the foundation from which to govern, share, secure, curate, federate, extend, and manage data-reliant, distributed, scalable ecosystems which are viable against longer-term horizons.[1]

- Without ICT, the value of locational data cannot be realised. There would be no means of putting the data to work: discovering, gathering, comprehending, cleaning, integrating, updating, managing, sharing, securing, analysing, interrogating or publishing it.
- Without ontological data and metadata disciplines, the usability of the data is diluted as it will either not be capable of meaningful analysis and interrogation (wherein lies value) or worse, there will be data chaos (wherein lies cost) and stasis (lack of interoperability).
- Without an understanding of ICT evolution, the danger is that geospatial data infrastructure (performance, security and scalability) will very quickly be overwhelmed by the pace of ICT change, and in particular the increased volume and types of locational data resulting from emerging technologies[2].

The realisation of the sustainable value of data as part of national infrastructure is underlined by the ODI’s statement:

> “In December 2017, the UK National Infrastructure Commission recognised data as part of the UK’s key infrastructure[3]. The ODI believes that data is as important as our road, railway and energy networks, and should be treated as such. A trustworthy data infrastructure is one that is sustainably funded and is directed to maximise data use and value, to meet society’s needs.”

So, in researching this topic, we have reached out to commercial industry expertise, relevant public sector authorities and also spoken at length with those on site and at street level – utilities and building engineers and operators.

Whilst Incorvus may have approached matters from a generalist data perspective, our team includes a senior structural resident engineer with experience of major UK public and private sector development projects (including secure sites); a former local government councillor with direct

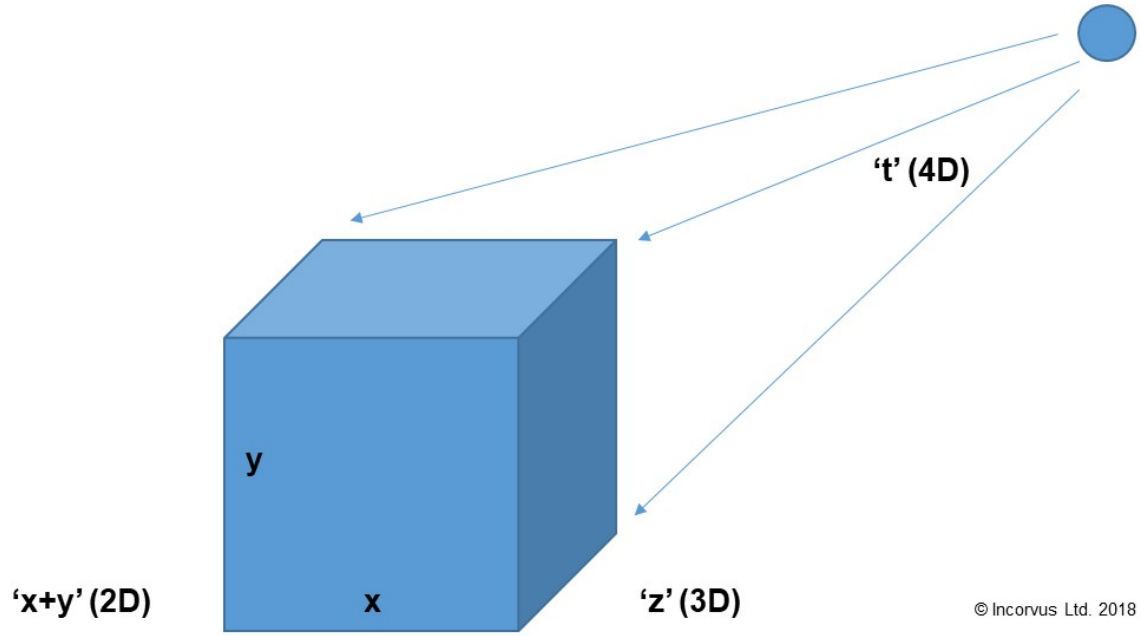
[1] Incorvus is an information governance consultancy, providing implementation services as well as thought leadership. Incorvus is currently an independent consultancy with no ties to any aspect of the geospatial market, in terms of business partnerships or licensing arrangements. www.incorvus.com
[2] https://www.fgdc.gov/ngac/meetings/dec-2016/ngac-paper-emerging-technologies-and-the.pdf
[3] https://www.nic.org.uk/publications/data-public-good/

experience of planning committees and urban planning issues and two principal consultants with extensive enterprise experience in information systems (BI[4]), governance[5] and big data[6].

The link between geospatial data and ICT is an important one. It is through technology (smartphones, satellites, sensors, cars and IoT) that geospatial (locational) data is generated and captured. So geospatial data, its value and application, cannot (in our opinion) be considered in isolation. In the 21st century, it relies on technology.

In the UK we have a heritage established in 2D, where even dataset layering evidences a 2D mindset. We are now in the era of 3D and fast moving towards 4D. We need to be thinking in terms of multidimensionality, 3D and embracing the possibilities of 4D.

We have a 'place to stand'; now we can 'measure' the earth!



We would like to thank Hugh Phillips (UKHO), Andrew Trigg (HMLR)[7], Nick Lindsay (OS), and Alex Wrottesley (Geovation) and Alan Leidner (OGC) and acknowledge their responsive co-operation in providing information and insight pertinent to this enquiry which we trust we have rendered faithfully and accurately. It is much appreciated.

Identified issues

From our investigations, Incorvus has identified the following specific geospatial issues:

- The lack of a coherent body of knowledge and consistent stance;
- The gap between real world data and legally acceptable data, particularly where this relates to property boundaries and title deeds;
- The disruption and cost caused by lack of, or inaccurate data on the as-built underground.

[4] Business Intelligence.
[5] Records management and audit.
[6] Enterprise data, data quality and content management systems.
[7] https://www.gov.uk/government/organisations/land-registry/about

The UK's Geospatial Data Infrastructure: Challenges and Opportunities paper[8] by the ODI has detailed other key issues such as, which we would also highlight:

- Political commitment;
- Legislative constraints[9];
- Licensing inconsistencies;
- Licensing vs. revenue;
- Lack of technologically-forward culture and thought leadership.

National Perspective

An efficient and effective geospatial system must both deliver on immediate needs and future expectations. This means a vision of a geospatial data environment, its uses, its interconnections and how it might be changed and extended to meet its potential in the UK. So we assume that the geospatial ecosystem will cover cadastral data for taxation, legal, maintenance and mapping requirements and be flexible to additional demands and services. A crucial component is the Government's appetite for this level of change.

In the geospatial sector, our basic belief is that in the UK, (where there has been a tradition of geospatial surveillance ever since the Domesday Book in 1085[10]) there is a valuable heritage of sound geospatial (or quasi-geospatial) data covering land, sea and underground but this needs bringing into the 21st century.

The pace of IT evolution and the data avalanche from IoT devices demands that organisations have forward-thinking data strategies and plan infrastructure accordingly. Operations, in the digital age, should not be constrained by fragmented processes, lack of ontology, or poor quality data. Instead the data gains value from integration, interoperability, accuracy, swift update and its flexibility meeting new and changing needs. Otherwise the productivity and efficiency of both the economy, as a whole and individual companies suffers.

Therefore the realisation of data value relies heavily upon the ability to integrate, interoperate and update intelligently in order to maximise openness and safeguard security whilst still retaining the data integrity which is the foundation of insight.

There appear to be key and far-reaching decisions required at the top level to facilitate the Commission's task, without which the lessons of history risk being repeated, and we are aware what a difficult topic such wide-reaching cultural change at this level is:

- **A cohesive political and legislative framework** regarding the roles and responsibilities of the various agencies pertinent to this area, where some of the regulation dates from the 18th century. Clarity and precision regarding interlocking areas of responsibility is needed to provide the unified data reference approach which the OGC recommended as best practice in 2015[11], for law enforcement and

[8] https://theodi.org/wp-content/uploads/2018/11/2018-11-ODI-Geospatial-data-infrastructure-paper.pdf
[9] Ordnance Survey's remit is determined by legislation written in 1841.
[10] "The Domesday Book provides extensive records of landholders, their tenants, the amount of land they owned, how many people occupied the land (villagers, smallholders, free men, slaves, etc.), the amounts of woodland, meadow, animals, fish and ploughs on the land (if there were any) and other resources, any buildings present (churches, castles, mills, salthouses, etc.), and the whole purpose of the survey - the value of the land and its assets, before the Norman Conquest, after it, and at the time of Domesday. Some entries also chronicle disputes over who held land, some mention customary dues that had to be paid to the king, and entries for major towns include records of traders and number of houses. http://www.domesdaybook.co.uk/faqs.html#1
[11] https://sensorsandsystems.com/ogc-announces-unified-geo-data-reference-model-for-law-enforcement-and-public-safety-an-ogc-best-practice/

public safety - and to make it simple and easy for everyone to engage with geospatial data in a connected, federated, digital world. A brief review of the UK law pertaining to the Telecommunications industry (and the role of Ofcom) shows how overlapping and incoherent the regulation has become as the nature of the industry has changed[12].

- **Consistency:** we have found that various government authorities seem to have different stances on key aspects of this topic. These manifest as asynchronous statements across Government; apparent logical inconsistencies even within a single web page; verbal and written contradictory evidence. The result of this is a lack of clarity and definition in key areas which must make the work of the agencies extremely difficult and which will continue to inhibit the work of the Commission unless resolved – and in saying that, we are very sympathetic as to why certain carefully chosen statements are the way they are. What we seek is clarity and consistency. As an example: HMLR's website understandably (given the nature of the old and hard copy scanned and textual information they are translating into usable and digital form) states: "We do not provide legal advice on precise boundary positions and responsibilities."[13] Yet on the same page, HMLR's responsibilities include: "to provide a reliable record of information about ownership of and interests affecting land and property, and, to provide owners with a land title, guaranteed by the government."[14] HMLR is placed in an impossible position.
- **Resource collation:** knowledge and understanding in relevant areas is distributed, even beyond UK boundaries, and, in order to avoid re-inventing the wheel, would it be helpful if one of the first steps was to determine where this knowledge is held so that a collective corpus of research, information and resource can be established. Much of the information that the Commission sought in this questionnaire is already detailed at length by the OGC and OS.
- **Assurances:** since the value of data is linked to the integrity of its accuracy and precision[15], this may impinge on the risk and liability standpoint of the Government. Does the Government continue to hand off risk if its data is to be used to power, for instance, autonomous vehicles – where bad data may cost lives? Given the nature of potential use cases, it is likely that data standards should involve re-consideration of acceptable (or legally defined) tolerances and also of what degree of assurance the data owners may provide to those in engineering, insurance, transport etc. where data error could give rise to consequent liabilities. Are current disclaimers adequate or even fair if Government intends to raise income from providing data or data services?
- **Tolerances and validity:** whilst the degree of accuracy required currently depends on context (i.e. core urban, urban, suburban and rural) the new applications of geospatial data may well enter environments where accuracy to a high scientific standard is needed to validate results. Agreement as to acceptable levels of tolerance and validity is required to assist interoperability between agencies, and to help close some of the gaps where the data does not have force of law.[16] One of the problems is that advances in technology have improved degrees of accuracy

[12] https://thelawreviews.co.uk/edition/the-technology-media-and-telecommunications-review-edition-8/1151648/united-kingdom
[13] https://www.gov.uk/government/organisations/land-registry/about
[14] https://www.gov.uk/government/organisations/land-registry/about
[15] https://www.thalesgroup.com/en/worldwide/four-vs-big-data
[16] https://www.ordnancesurvey.co.uk/resources/property-boundaries-owners.htm

considerably and this is not necessarily reflected in currently held geospatial data. How will the Government decide what constitutes data validity and valid data? HMLS has, for instance, stated that "the register doesn't create good data".

- **Force of law:** currently geospatial data in the US has force of law. "A parcel's boundary is important for a property's legal description. A legal description is a detailed and specific geographic description of a parcel of land that is used to identify it for legal transactions, such as buying and selling property. The legal description is important because it tells you what exactly the law will recognize that you own. The legal description is always included in any deed transferring property so the person receiving the property knows what he's getting. If a deed contains an ambiguous legal description, title to the property may be unmarketable. A marketable title is title that is reasonably free from defects and claims from other parties, such that a reasonably prudent buyer is willing to accept it. For example, a legal description may show a gap in the boundary of the property so there is no certainty of the contours of the perimeter…."[17] Though OS MasterMap is now used by local government as a background to planning issues, local government is solely focused on applying UK law and may, *in reduction ad absurdum*, grant planning permission to someone who doesn't actually own the land or property in question[18]. Government generally does not appear to make links between real world data and legal definitions though we accept that agencies have much of this information, it just isn't regarded as a legally acceptable definition; the mechanism isn't in place for that to happen; or the agencies' own remit inhibits it, and at the moment, Incorvus understands that there are no plans to make it so. HMLR's website understandably (given the challenging nature and volume of the information they are translating into usable and digital form) states: "We do not provide legal advice on precise boundary positions and responsibilities."[19] Yet on the same page, HMLR's responsibilities include: "to provide a reliable record of information about ownership of and interests affecting land and property, and, to provide owners with a land title, guaranteed by the government."[20]
- **Property boundary data:** HMLR's own commentary on boundaries states: "If you live in England or Wales, there's usually no record of the exact boundary between two properties; or, who owns the hedge, wall, tree or fence between 2 properties". (Different rules apply in NI and Scotland). They also state: "You can get an idea of where the boundaries for your property are by looking at its title plan. Most title plans don't show exact boundaries - you usually don't need to have the exact boundaries recorded anywhere."[21] (Please also see Appendix 1.)
- **Standardisation:** Utilities companies, *inter alia*, all use different processes, measures and operational standards. This will inhibit the work of achieving a coherent, unified map, particularly since we have been told that the relevant private sector companies are not keen to disclose such information. The practical impact of this lack of standardization is a high degree of error regarding the 'as-built' underground assets. In the US, this can result in electrified manhole covers (poor

[17] https://study.com/academy/lesson/property-boundary-lines-legal-definition-special-situations.html
[18] We do accept that sometimes there are exceptions which are meaningful, such as prospective buyers or developers applying for planning permission in principle, before committing to purchase.
[19] https://www.gov.uk/government/organisations/land-registry/about
[20] https://www.gov.uk/government/organisations/land-registry/about
[21] https://www.gov.uk/your-property-boundaries

dogs![22]) and in the UK, stasis, where the sharing of boxes by electrics, gas and telecoms services can prevent street level works from proceeding as it is considered too dangerous, even with specialist training in place.

- **Commissioning:** From an implementation perspective, it is axiomatic that implementation will use agile and adaptive processes (which embrace evolution) but that also respect the rigors of proper Government tendering as well as the need to evolve the correct solutions. Currently, the public sector is still trying to reconcile these.
- **Realising value:** The leading work done by OS and HMLR to date in generating data product with already proven output value is not recognized. There has to be a cultural shift so that these products are no longer described internally as: "the exhaust fumes of the business!"

Data Perspective

Our geospatial vision is very much along the lines of the philosophy of the OGC – a single, unified map record, currently in 3D but eventually embracing the 4th dimension, 'time'.

What Alan Leidner[23] at the OGC says (admittedly in reference to US utilities) is that:

> "Most major cities in advanced nations have underground infrastructure layers that include water, sewer, gas, electric, steam/district heating, transit and telecom. There is also an underground environment to consider including bedrock, streams, water table, soils, foundations, basements and vaults. Key to being able to use all this data interoperably requires:
>
> > 1) All utilities adopt a common, highly accurate photogrammetric basemap with positional accuracy of 3". Other common layers that are also useful include building footprints, curblines and delineated utility features like manhole covers, catchbasin grates, fire hydrants, subway ventilation grates and station entrances. These are available if the municipality has developed an enterprise GIS system with basic foundation layers that enables enterprise spatial data integration. Utilities use the common layers to register their own network data.
> >
> > 2) All utilities collect information about their networks including key features and attributes. Data needs to be accurate, complete and interoperable within a common data model - which is what OGC is now working on. Such layers registered to a common basemap will share relational accuracy with each other and can be reliably used/modeled/analyzed together."

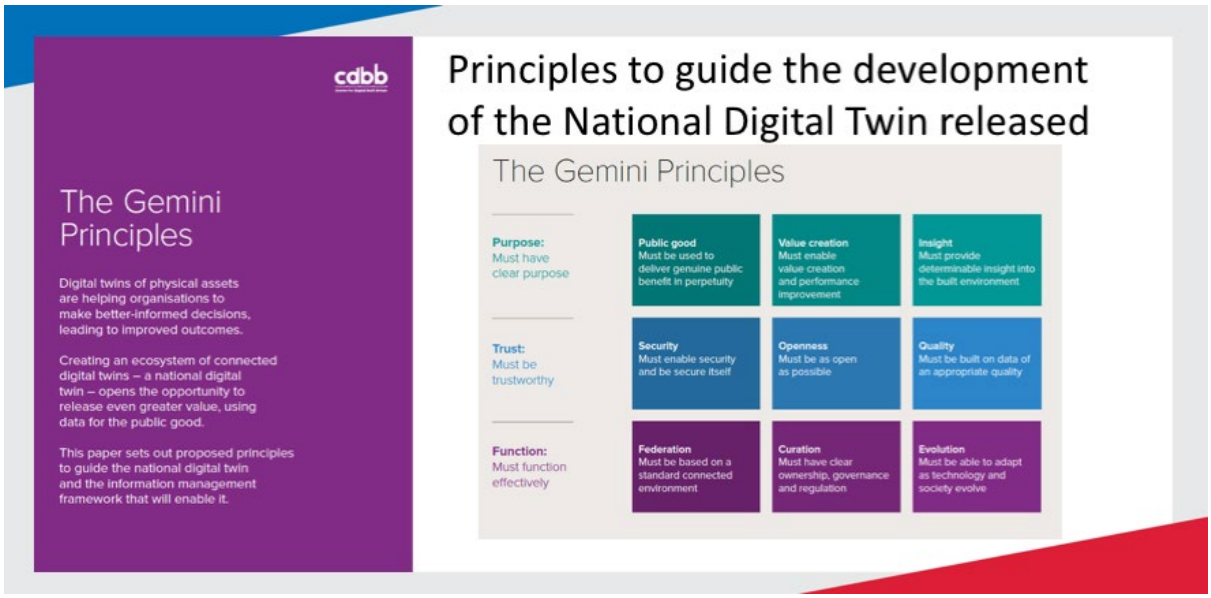
Our views are independently arrived at, but our data-centric approach seem very much in keeping with the US Federal Government NGAC paper, which says:

> "To get to the value of big data one must understand the ecosystem of technologies feeding and supporting big data. Advancement in web technologies has driven our connected world to the proliferation of data services, cloud software and hosting, platform integration, smart devices, and the Internet of Things (IoT). These advancements yield massive amounts of varied and continuous data – big data. While big data itself does not necessarily translate to

[22] https://nypost.com/2017/02/13/dogs-zapped-after-stepping-on-electrified-manhole-cover/
[23] Email received 14/12/2018.

knowledge, however, GIS and geospatial data provide the context, analytic capabilities, and understanding to the big data to better inform decisions."[24]

The same appears to be the case with the Gemini Principles generated by the Cambridge Centre for Digital Britain, .[25]



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Whatever the eventual application of the UK's geospatial heritage, Incorvus believes that the road to it begins with data centricity. This approach generates consideration of other generalizable data principles that may be relevant:

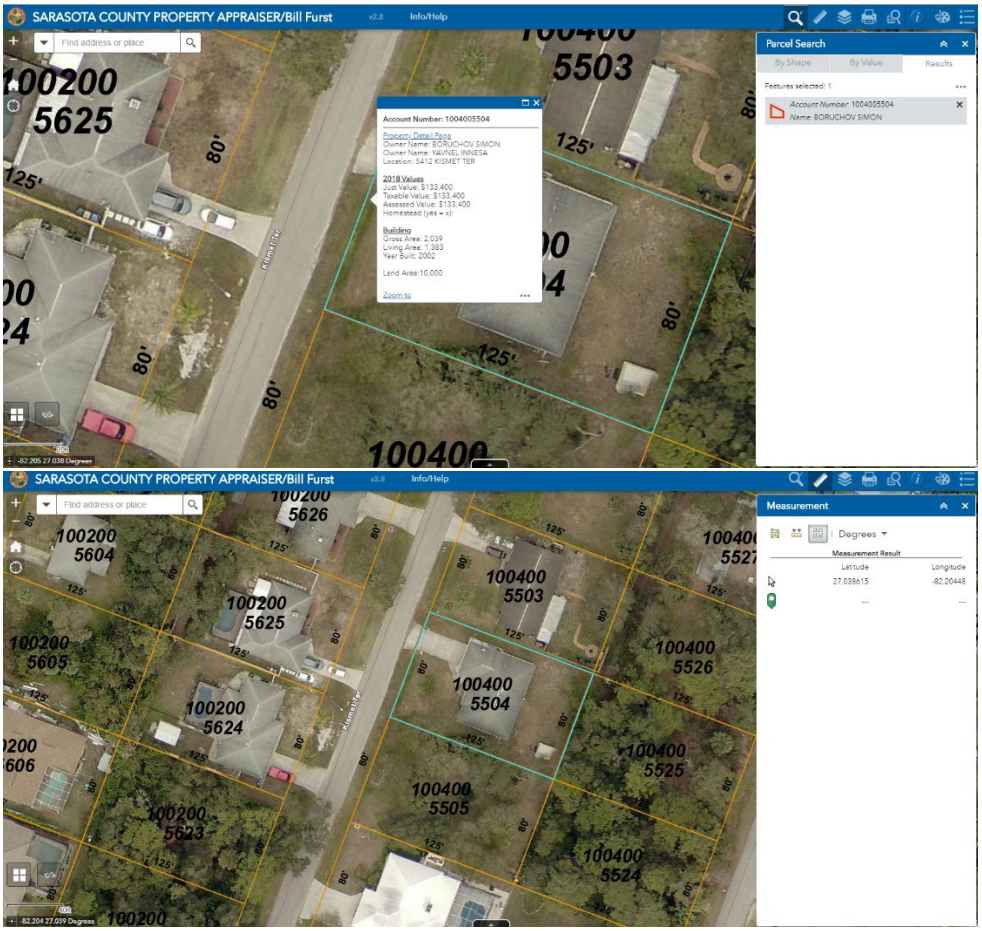
- **A data centric approach:** what we mean by this is taking the data as the 'common denominator' of any system or requirement and focusing on the quality, description, interoperability and flow of the data as the starting point, not on applications. Application-led computing has led to siloed, proprietary, non-interoperable environments, replicating organizational boundaries rather than transcending them to achieve real-world processes. Data descriptions should include the 'what', 'when', 'where', 'who by' and 'how' of the data required within the ecosystems in order to enable its use; management, access, discovery, disclosure, transport, validation, aggregation, federation, permissioning, unification and integration to other systems and data; and how this is to be achieved within federated environments, via multilateral input channels, over the data lifecycle and whilst preserving interlocking datasets over a broad spectrum of open-closed data.
  The data, its provenance, lifecycle and publication will be a 'record' maintained over time, in order to retain value. This requires quality data, properly described (metadata), contextually rich (ontology and permissioning) and capable of being more than a static asset (workflow, interoperability and ecosystem) that is not of sustainable quality, accuracy or usability.
  Howard Veregin states: "Once data make their way into GIS they typically begin a

[24] https://www.fgdc.gov/ngac/meetings/dec-2016/ngac-paper-emerging-technologies-and-the.pdf Page 4.
[25] The Centre for Digital Built Britain is a partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge to deliver a smart digital economy for infrastructure and construction for the future and transform the UK construction industry's approach to the way we plan, build, maintain and use our social and economic infrastructure.
https://www.cdbb.cam.ac.uk/AboutDBB
[26] https://www.cdbb.cam.ac.uk/images/Carousel/2018DecGP

process of metamorphosis in which they are transformed and merged with other data in support of queries, analyses, and decision-making models. Unfortunately there is no guarantee that the data are suitable for such applications. This problem is sometimes referred to as 'use error' (Beard 1989)."[27]

- **Plan for bigger data:** whilst geospatial data itself, as published by agencies, may not be 'big data', other sources of geospatial data may be somewhat bigger. In our view, it would still be sensible, given the anticipated increases in globally-generated data volumes[28], to plan for a lot more data than is currently held since the advent of IoT devices alone will have considerable impact on data volumes and scalability is an enduring ICT problem.
- **Time-series data:** whilst geospatial data itself may change slowly, it nonetheless changes over time (4D) and part of the value to be realized from it is in comparative and trend analysis. Time series data, especially if in volume (as is the case with satellite and earth observation data) will have significant volumes. One aspect of really valuable data is the ability to provide analysis and reporting in real time.
- **Dark data:** organizational data which is not understood (and therefore not used) by organisations, typically constitutes 80% of an organisation's data estate. This represents a considerable cost and effort leakage if unaddressed.
- **Data granularity:** Many local authorities use OS MasterMap data but underlying data is not necessarily openly available. Wandsworth Council has maps, for instance, which show boundary data but do not give access to the geospatial data which underlies it.[29] In the US, geospatial data and taxable value data is openly on display on town hall websites.[30]

[27] https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch12.pdf, Page 186.
[28] https://www.thalesgroup.com/en/worldwide/four-vs-big-data
[29] https://maps.wandsworth.gov.uk/
[30] https://www.sc-pa.com/propertysearch/parcel/details/1004005504 with link to map at https://ags3.scgov.net/scpa/?esearch=1004005504&slayer=0&exprnum=0.



- **Data quality components**[31]: Howard Veregin details specific considerations with regard to geospatial data quality: spatial accuracy, temporal accuracy, thematic accuracy, spatial resolution, thematic resolution, precision, consistency, and completeness.

Table 1 Data quality components in SDTS.

Component	*Description*
Lineage	Refers to source materials, methods of derivation and transformations applied to a database. ● Includes temporal information (date that the information refers to on the ground). ● Intended to be precise enough to identify the sources of individual objects (i.e. if a database was derived from different source, lineage information is to be assigned as an additional attribute of objects or as a spatial overlay).
Positional accuracy	Refers to the accuracy of the spatial component. ● Subdivided into horizontal and vertical accuracy elements. ● Assessment methods are based on comparison to source, comparison to a standard of higher accuracy, deductive estimates or internal evidence. ● Variations in accuracy can be reported as quality overlays or additional attributes.
Attribute accuracy	Refers to the accuracy of the thematic component. ● Specific tests vary as a function of measurement scale. ● Assessment methods are based on deductive estimates, sampling or map overlay.
Logical consistency	Refers to the fidelity of the relationships encoded in the database. ● Includes tests of valid values for attributes, and identification of topological inconsistencies based on graphical or specific topological tests.
Completeness	Refers to the relationship between database objects and the abstract universe of all such objects. ● Includes selection criteria, definitions and other mapping rules used to create the database.

[32] This document also addresses metadata and cartographic bias (e.g. choice of coordinates, visualization types[33] etc.)

[31] See https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch12.pdf Table 1, Page 184.
[32] https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch12.pdf, Page 184.
[33] https://uark.libguides.com/c.php?g=79179&p=511869

Howard Veregin also states: “Despite the advances we have made in understanding components of data quality, we have made almost no progress in the development of rules and heuristics to assess fitness-for-use and prevent use error (see Beard and Buttenfield, Chapter 15).”[34]

- **Unified, single version of the truth:** When one of the Incorvus team looked up his own property, he found there were multiple document references – effectively multiple versions of the truth. This is an issue that HMLR are aware of and addressing as they understand its impact elsewhere on data integrity but it is a big task and will take a long time, affecting Commission project timetables.
- **Data standards:** Currently we believe that data standards provide an important building block that need to be put in place to ensure sound foundations to geospatial systems and to deliver the correct quality information at an economic price for many and varied uses.
- **Unifying points:** And as in real world surveying, somewhere there has to be a stake in the ground – a control point, a primary key in the geospatial database, from which everything else hangs, and continues to do so, even as data changes over time.
- **Prioritised digitisation of data legacies:** because of the UK’s long history in this area, its institutions have valuable informational 2D legacies, in this particular context, libraries and registers of non-digital material (rough drawings, scans, supporting documentation, charts, handwritten text and unstructured data in either text or photographs) which will require special treatment and digitization before their value and intelligence can be realised. Typically this does not come cheap and it will be time-consuming. That being the case, there will be priorities to be evaluated and a desire to see how automation and machine-learning can assist in delivery. In the case of HMLR and the Hydrographic Office[35] we understand there is a wealth of early documentation, much from the 19th century.
- **Data management:** An enduring issue will be the sustainability of the quality of information over its lifecycle.
- **Data governance:** only a data-centric standpoint offers the necessary discipline with flexibility necessary to both share and secure data.
- **Data ontology:** Data structure (hierarchical taxonomies and term lists) and description (metadata) is vital for interoperability, analysis and integration. The analysis and search requirements of big data rely heavily on metadata which itself has to be coherent within an overall ontology, including agreed terminology and hierarchical relationships. Critically, as Howard Veregin pointed out, only a few commercial GIS systems make any (or adequate) provision for metadata.[36] The latest statement from Veregin on this in 2018 is: “The context within which geospatial data are used has changed significantly during the past ten years. Users have now easier access to geospatial data but typically have less knowledge in the geographical information domain, so have limited knowledge of the risk related to the use of geospatial data. This sometimes leads to faulty decision-making that may have

[34] https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch12.pdf, Page 186

[35] “Ca. 150,000 record copies of British Admiralty navigational and miscellaneous charts, and published chart catalogues; 100,000 hydrographic surveys, reports and geodetic data; 14,000 ocean sounding sheets; 45,000 foreign charts and published chart catalogues; 2,000 aerial photoplots; 3,500 copper plates; 1M. Notices to Mariners; views; atlases; manuscript papers, letters, journal, logs, etc., (mainly 19th century). Other textual hydrographic information held in several hundred thousand files.
Catalogues, card and graphic indexes, continually updated; microfilm and photographic reproductions; loans of data, publications and records; information service.” http://www.cartography.org.uk/map-collections/united-kingdom-hydrographic-office/

[36] https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch12.pdf, Page 185.

significant consequences. In order to reduce these risks, geospatial data producers provide metadata to help users to assess the fitness for use of the data they are using within the context of their application. However, experience shows that these metadata have several limitations and do not reach their information goal for this new group of non-expert users. In addition, geospatial data are becoming a mass product that has to follow legal requirements related to this class of products. Metadata, as currently defined, do not reach these obligations, especially concerning the requirements for easily understood information about product specifications and potential risks of misuse. This paper describes an approach that aims to reduce these risks of misuse by comparing data producers specifications and data users' needs and providing indicators describing data quality to users."[37] (Compare OGC standards[38] and ESRI data interoperability standards.[39]) Interoperability relies on cross-governmental (and private sector) ontologies that enable coherent communication.

- **Data infrastructure:** Earth observation data and satellite data in particular is overwhelming in its volume where typically analysis is streamed and a superfast database is required to cope with ingestion. IoT data, particularly from autonomous vehicles is likely to go the same way. Data of this volume, given a desire for real time analysis and delivery, will have specific technology infrastructure requirements.
- **Data in motion:** Data is now understood in a richer way – to be in motion as well as static. This leads to consideration of processes and workflows and the need to identify potential problem areas, pinch points in the infrastructure which may lead to stasis or geospatial indigestion.

[37] https://www.researchgate.net/publication/228597904_Spatial_data_quality_From_metadata_to_quality_indicators_and_contextual_end-user_manual

[38] https://www.opengeospatial.org/standards

[39] https://www.esri.com/en-us/arcgis/products/arcgis-data-interoperability/supported-formats

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Geospatial Commission's (GC) definition of geospatial data appears to be "information where place is a key feature of its source and/or purpose for which it is used." Here and elsewhere, the term geospatial data itself seems to be broadly used, embracing not just coordinates and polygons but also related data and use cases e.g. addresses where, strictly-speaking, the data is not geospatial per se. So, just how narrow the definition of geospatial data should be? If the definition is broad, then justifiably the list of included data types will be very broad too and it is probably not worthwhile at this stage detailing all the possibilities. If the definition is narrowed, then what are the implications and risks of omitting items such as address data, from that definition?

The US University Consortium for GIS (UCGIS) evaluated a similar problem with regard to its own legislation: "The stated goal is focused on strengthening efforts at building the National Spatial Data Infrastructure (NSDI) and to reduce duplicated efforts by various agencies in authoring geospatial data. While these are certainly goals that are shared by many in the wider geospatial community (including UCGIS), several organizations, such as COGO[40] and AAG, have noted that some of the language in the bill is unnecessarily vague and may be interpreted to exclude many institutions and individuals currently producing geospatial data for the government." And herein lies the rub, since the granular, pervasiveness of geospatial data is likely to widen as IoT develops – as ESRI says: "everything is somewhere".

The US legislation, the Geospatial Data Act, lists 18 specific use cases, including:

- "georeferenced data transcribed into a Geographic Information System or Land Information System format by manual or electronic means, and the maintenance of that data;"
- "tax parcel maps, zoning maps, and other public data records transcribed into Geographic Information System or Land Information System formatted cadastres, and the maintenance of those cadastres if the data are not modified for other than graphical purposes;"
- "data depicting the distribution of natural or cultural resources, features, or phenomena;"
- "data used by a Federal agency (including contractors of a Federal agency) in the preparation or transcription of documents or databases into a Geographical Information System or Land Information System format in the preparation or transcription of Federal census or other demographic data."

A more exhaustive list and critique can be found here: but in summary, UCGIS was concerned that the effect of the legislation would engender exclusionary procurement, something the UK public sector is prone to. UCGIS quotes the American Association of Cartographers: "The Geospatial Data Act (GDA) of 2017 (S.1253) would set up a system of exclusionary procurement that would prevent most companies and organizations in the dynamic and rapidly growing GIS and mapping sector from receiving federal contracts for a very-wide range of activities, including GPS field data collection, GIS, internet mapping, geospatial analysis, location-based services, remote sensing, academic research involving maps, and digital or manual map making or cartography of almost any type."

By data types, the Geospatial Commission appears to be referencing the following which we, from a systems perspective, do not normally consider to be 'types' of data, and which may not be sufficiently rigorous in their definition:

1. Geospatial data: Information where place is a key feature of its source and/or purpose for

[40] COGO is the entry of spatial coordinate data points, usually obtained from field survey equipment. https://gisgeography.com/gis-dictionary-definition-glossary/

which it is used.
2. Positional data: Groups of individual datasets that usually have location as a secondary purpose, and which describes activity or physical assets grounded in a particular place.
3. Geospatial identifiers: Data that provides the means of anchoring positional data to core geospatial data.
4. Geospatial services: Higher-level insights and products, often involving layers of various types of spatial information.

The definition of geospatial data has already been discussed. It remains to be seen whether the alternative terms 'locational data', 'positional data' or 'data linked to place' are perhaps truer renditions more appropriate to the Geospatial Commission's work. We feel that the 3rd item above should be described as geospatial referencing, since it provides referenceability, not just identification. With the prevalence of IoT, we do not see the separation between the 1st and 2nd items quite so distinctly. For us, everything has a geospatial position so we would amalgamate those two items giving a resultant 'type' list of geospatial data, geospatial referencing and geospatial services.

For us, types of data start with basic categories: structured and unstructured. Structured data is data that is already…'structured', usually found as numeric data in spreadsheets or databases – vector data would fall into this category.

From a technology perspective, unstructured data is relatively easy to work with as the existing structure enables it to be understood, manipulated, modelled and queried. Unstructured data is commonly understood as anything that does not meet these criteria: encompassing many types of digital items: graphics, photos, scans, free text in e-mails and on social media, documents, videos, audio files, biometric information and so forth. Rasterised data such as satellite imagery (and the descriptive text which is found on title deeds) would fall into this category.

Then we would turn our attention to 'dark data'. Dark data may include, but it is not exclusively, unstructured data. Any data which is not understood or used, is dark data. Since dark data is typically 80% of any organisational data (and mostly unstructured as this is the most difficult to describe and effectively 'structure') that the Commission might want to discover what data is currently held in relevant institutions that would qualify as 'dark data' since by implication, the data that is 'in scope' will be the 20% minority that isn't.,

Rather than considering data types individually, as these will evolve as IT and use cases evolve, we would advocate retaining focus is on a standards-based approach e.g. what types of data, formats, or data protocols would be regarded as standard by the Geospatial Commission, at least initially? What is required for interoperability?

The graphics industry established the JPEG Group in 1983 when there was a realisation that the various technology companies (Adobe, IBM etc.) and user groups, were frustrated by the costly lack of interoperability with regard to still (binary) images. This led to the creation of the .jpeg standard now familiar to all web programmers and Photoshop users. In 2011 they moved on to consideration of "Information technology – JPSearch – Part 5: Data interchange format between image repositories".

Similar challenges were faced by the motion picture industry when trying to achieve interoperability in terms of audio-visual (A/V) compression, storage, coding, definition, format, transmission, control, and subsequently, high-efficiency coding and streaming. Their response was to set up the MPEG Group in 1988: "a working group of authorities that was formed by ISO and IEC to set

standards for audio and video compression and transmission". Since 1988 this international body has incrementally updated the MPEG standard to take account of new issues, use cases and technology developments.

In both instances, prior to the standards being agreed and rapidly established, there were a plethora of graphics and A/V file formats across multiple platforms and technologies which made it difficult for people to work together and share materials. Undoubtedly the standardisation of MPEG and JPEG made a remarkable difference to the film industry and others. (MPEG was approved as the standard for storage and retrieval of moving pictures and audio on storage media in November 1992.)

The MPEG Group is now looking at compression technologies for neural networks as it foresees the relevance of this Artificial Intelligence (AI) technique in relation to "devices, which may have limitations in terms of processing power and memory" (e.g., mobile devices or smart cameras). So the MPEG Group continues to introduce innovation and some of its current areas of investigation may well be relevant to the Commission e.g. with regard to colour (satellite earth observation data imagery).

As MPEG says: "In its 30 years of activity MPEG has developed an impressive portfolio of standards and technologies that have created an industry worth several hundreds billion USD. In a world where information technology, consumer electronics, entertainment and telecommunication products and content variously converge by incorporating increasingly sophisticated technologies and the need for timely available standards is as strong as ever, MPEG provides a proven mechanism to bring research results into standards that promote innovation for the benefit of all." By implication, this establishes a standard but inclusive approach to relevant, agreed data types, protocols, schemas, coding, formats and API libraries – all intended to support interoperability. We are aware that OGC, OS and others have done a great deal of work on standards.

What should be excluded are file types which are regarded as proprietary as these will hinder openness and interoperability. If the lesson of the JPEG and MPEG groups is to be heeded, this work should include major industry players such as ESRI who publish a list of their ArcGIS interoperability standards. GML and WMS, for instance, feature on the OGC, OS and ESRI lists, whereas WMS does not appear on the ESRI list. The rationale here seems to be ESRI's focus on working with other vendors' software e.g. Oracle, Northgate, and Intergraph.

One other lesson from the work of the MPEG and JPEG groups is that they were international: comprising leading agencies, vendors, industry representatives, users and advocates. Something similar may be required if the Commission is to provide a similar uplift to UK geospatial data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Ensuring the capability for developing geospatial capability and realising value, both in the immediate and longer term, depends, not only on geospatial knowledge and skills but also a wider grasp of the ICT needed to implement systems which can do that – across the ecosystem of developers, planners, businesses, related sectors, vendors, agencies, civil servants (in local and national government), procurement, academia, operatives and end users. In our introduction, we have already stated, and it bears repeating, the value of geospatial data will only be realised through having the right teams and a data-centric systems approach. Geospatial data is generated and captured by the latest generation of ICT technologies.

ICT and culture

If this seems indulgent, we refer the Commission to the track record of notable and expensive failures in UK public sector IT. Our observations, which we believe align with the findings of Richard Bacon MP[41], formerly on the Public Accounts Committee, who has written extensively upon the subject including co-authoring a book, "Conundrum"[42].

The conclusions of Conundrum, as summarised by Dr. Jim Dale, a respected project management consultant, should be a prick to our consciences:

> "What is so depressing is that the same old common causes of failure emerge time and time again:
>
> - Ill-defined roles and responsibilities
> - a high churn / turnover of senior staff
> - corporate amnesia with lessons not being learnt or applied
> - skills / experience gaps
> - woeful user / stakeholder engagement
> - poor financial management
> - sloppy procurement
> - inadequate / inappropriate risk management
> - misunderstanding the cultural challenges.
>
> In his book Richard Bacon reminds us that 'culture eats strategy' for breakfast.
>
> When I was appointed as a Government Gateway Reviewer many years ago I was advised to expect to see these recurring common causes of programme and project failure and sadly I must report that I have."[43]

Mindful of some Cabinet Office progress regarding the use of agile and the development of recent procurement frameworks such as the Digital Marketplace and G-Cloud (now in its 10th iteration), we would nonetheless add the following to the previous list:

- poor and outmoded ICT understanding, vision and design;
- an application-centric, rather than a data-centric approach;

[41] https://www.theguardian.com/society/2013/sep/18/nhs-records-system-10bn
[42] https://www.amazon.co.uk/Conundrum-every-government-things-wrong/dp/1849545529
[43] https://www.apm.org.uk/blog/learning-from-the-misfortunes-of-others/

- a preference for comfortable systems integrator 'big' contracting with consequent cost escalations and results;
- an over-reliance on Prince II and other overly complex project management methods which are not consistent with agile, leading to allegedly agile procurements with fragmented but waterfall contracts;
- 'big design up front' instead of 'enough design up front – the future is a foreign country and long procurement lead times generate redundant specifications in a time of rapid IT evolution;
- since the introduction of agile, a fractured approach to specification (and therefore procurement) which abandons the important contextual overview of projects and leaves critical aspects of enterprise computing – handshaking and integration – to the four winds, as responsibility for them is not attributable;
- insufficient attention paid to data and metadata quality and data integrity, and interoperability and coherent ontology.

We include this prompt because of the recurrent nature of these problems and as a reminder that 'culture' eats strategy. The Commission's ambitions remain vulnerable to these two issues no matter what excellent work is achieved elsewhere.

Geospatial skills in the public sector

National Mapping Agencies (such as the Commission's partner bodies), central and local government GIS practitioners constitute major UK resources in this area. It is, in our opinion, vital to ensure that the national mapping (and similar) agencies, (as not all are part of the Geo6[44]) are properly resourced, so that they can get onto the front foot as much as possible. They provide the data (and standardisation) linchpin to which other datasets are referenced.

Regarding academic institutions, we would hold up Cambridge and Edinburgh Universities as examples of what is required. Our knowledge of this area is limited but from what we know of ICT, for instance, our belief is that technical expectations ('the expectation gap')need to be reset much higher if we are to compete. UCL, for instance, has what appears to be an appealing program with bursaries[45]. So perhaps some Government bursaries for suitably qualified candidates (at least a second class Bachelor's Degree) could be a way forward for encouraging individual excellence – perhaps bursaries in part sponsored by geospatial companies and with the liaison through to the Geo6? This would also build links between the public and private sectors.

In the same course though, we note that the ICT thinking which underlines the course may be in need of refresh as it includes "programming and app development", which does not reflect the new data-centric world. UCL details, as contributing to future employability:

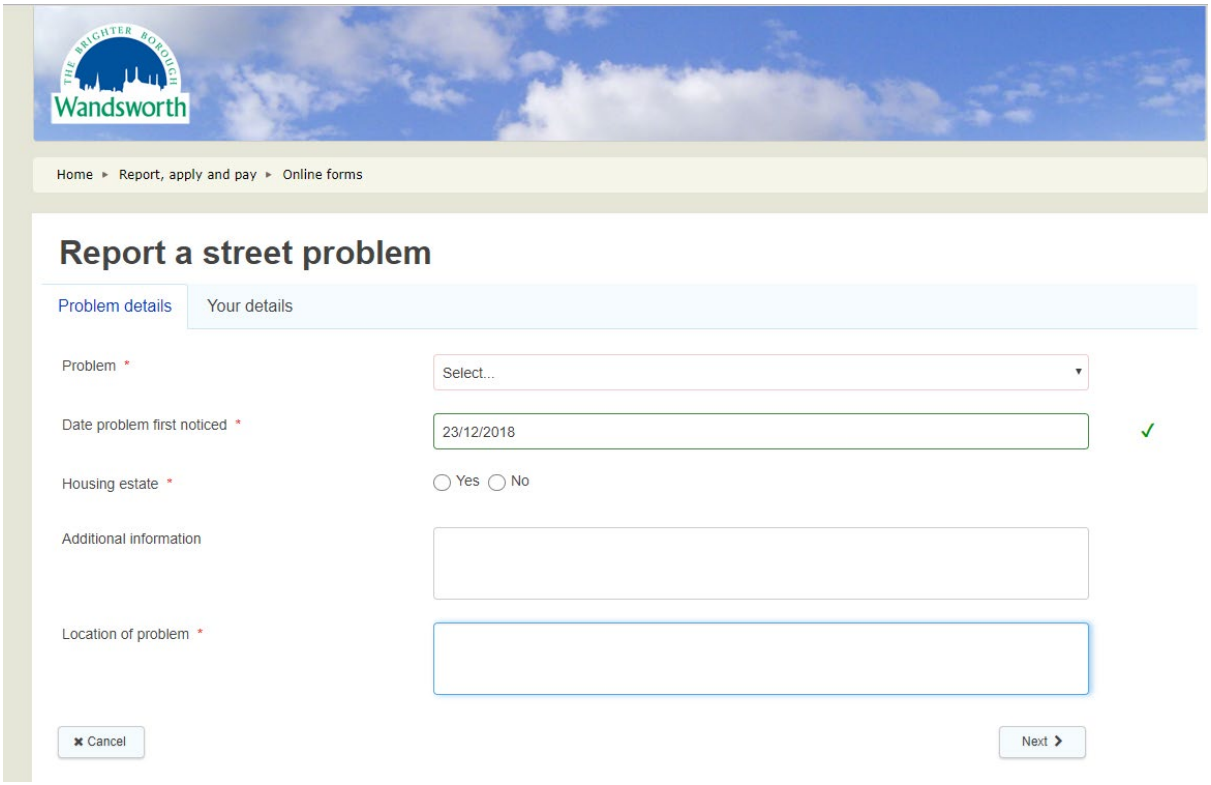
> "Students will gain a range of technical skills in geospatial science that are highly valued by employers, including the use of specialist software for GIS (ArcMap, QGIS, FME, Revit, PostGIS); programming, web and software development (Python, R, Java, Javascript,

[44] https://theodi.org/wp-content/uploads/2018/11/2018-11-ODI-Geospatial-data-infrastructure-paper.pdf Page 21.
[45] https://www.ucl.ac.uk/prospective-students/graduate/taught-degrees/geospatial-sciences-geographic-information-science-computing-msc

HTML/CSS, PHP); geospatial data acquisition, processing and management; geospatial data visualisation and analysis."[46]

There is a reference to 'data management' but for some reason, the whole impression is rather compartmentalised. There is for instance, no apparent sense of overall information architecture; no mention of metadata or interoperability; or any of the present questions which inform current ICT thinking. We understand why the UCL course focuses on certain 'industry standard' products (ArcGIS, FME etc.), but this does seem to be rather narrow-band in its thinking. As Digital Globe put it: "The world is changing quickly. What used to be science fiction is now reality."[47]

Currently Local Government authorities rely on OS MasterMap for data when considering planning, but instead of embracing 3D capability, typically a basic 2D 'floor plan' presentation is included as a static graphic within documentation. This does not link, at least within the London Borough of Richmond, to actual OS online data and supplementing information, such as flood plain risk. So the way that LG's use geospatial data is limited. Their thinking is still in 2D. Wandsworth Borough is regarded as more adventurous but even their reporting forms (potholes[48]) do not include any geospatial links.



[46] https://www.ucl.ac.uk/prospective-students/graduate/taught-degrees/geospatial-sciences-geographic-information-science-computing-msc
[47] https://www.digitalglobe.com/the-digitalglobe
[48] https://wandsworth-self.achieveservice.com/AchieveForms/?mode=fill&consentMessage=yes&form_uri=sandbox-publish://AF-Process-84b531be-8c33-4608-8a54-236f3e7f674f/AF-Stage-4e6d7516-71bd-4be0-a64b-7a5f6de3a7b1/definition.json&process=1&process_uri=sandbox-processes://AF-Process-84b531be-8c33-4608-8a54-236f3e7f674f&process_id=AF-Process-84b531be-8c33-4608-8a54-236f3e7f674f

Whereas in Indonesia for example, potholes reported by smartphone under the OneMap initiative[49], giving instant geospatial coordinates for the offending hole.

Planning data and practice, and its support by the use of geospatial data, differs widely amongst the many UK Local Government authorities. Some local authorities are better prepared than others and have a better skill base. So local government represents an area where the public sector geospatial skill and culture base, needs supporting.

It is also worth remembering that a change of political administration can result in a change of priorities. For example, in March 2018 the London Borough of Richmond-upon-Thames then administration launched a Digital Strategy that included, *inter alia*, a 'look at the relationship between Planning and Digital infrastructure proposals: to embed Digital into the Local Development Framework; to look into updating the Local Development Plan if required; to streamline the approval process for planning applications; and to enhance connectivity for residents and businesses.' However, a few months later, the incoming administration scrapped the position of Cabinet Member for Digital Strategy, who would have been charged with implementing the changes and improvements.

Looking at the school curriculum, admittedly at a reference from 2014 (which may have moved on since then) the word 'geospatial' is not even mentioned.[50] Curricula focused on core skills are really important – we are great advocates of the three R's – however, in a world where almost every discipline now has major ICT components, it seems short-sighted not to at least mention the 'G' word. The 2014 curriculum as a result, would not attract any smart pupils who are really up to speed on their own use of technology (Facebook, WhatsApp, smartphones etc.) and who are keen to pursue that in real life. Our National Geographic Curriculum also seems to have rather low expectations of the subject matter, although it does at least mention 'GIS'.[51]

The point being made here is that whilst a focus on traditional subject disciplines is important, the way those disciplines are related to current technology needs to be modernised. It is no good pretending we are equipping the geoscientists of the 21st century if the toolset they examine does not cover some aspect of modern geospatial advances. We are also not stimulating the interest and passion that is needed for pupils to be motivated towards these really interesting areas.

Incorvus recently attended an event held by KX systems, where the speakers included Mark McCaughrean, Senior Science Advisor at European Space Agency (ESA) and KX were showcasing their superfast Kdb database technology which is being used extensively to ingest and analyse space data.[52] We would defy anyone, even technophobes, who saw Mark's mind-blowing presentations not to be utterly enthralled and excited by the topic. This is the inspiration that is needed if we are to generate a national resource for future years that is enthused, but also appreciative of the educational standards required because they can see at first hand, the rationale for those standards.

Geospatial skills in the private sector

[49] http://ggim.un.org/knowledgebase/Attachment279.aspx?AttachmentType=1
[50] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/301253/GCSE_geography.pdf
[51] https://www.gov.uk/government/publications/national-curriculum-in-england-geography-programmes-of-study/national-curriculum-in-england-geography-programmes-of-study
[52] https://kx.com/solutions/space/

The problems of resourcing are common to both public and private sectors, except the private sector already has a solution in play (and not just for geospatial skills, but general ICT skills as well as these suffer from the same educational issues).

Private sector technology companies are now setting up their own 'universities'[53] :

- to develop a resource for the skilled personnel they required, with the right skills and the right level of skills;
- to bridge the expectation gap;
- to address the lack of training elsewhere and as part of resource planning;
- to promote stakeholder adoption and understanding, towards a self-help, which is good for clients and good for business.

In our view commercial 'universities' have been a real success in ICT – perhaps something similar could work for geospatial skills?

In the commercial sector, expertise is particularly found in engineering, building, architecture, transport, surveying, technology, communications, utilities and specialist companies (established and start-up) with an interest in locational data. Because of the pervasiveness of locational data, it is actually simpler to regard most sectors as having some kind of expertise. And this is not restricted to UK companies, nor locational specialisms, since online businesses based internationally aggressively use and need UK geospatial data e.g. Amazon, Facebook, Google etc. They already have models for where the value of geospatial data lies and have had systems successfully doing that for some time. They may also have models and details of what skills they require and where and how they find and nurture them. This may short-circuit the process of trying to establish what is required.

To realise the Commission's vision there needs to be a collaborative approach. The public sector has an expert role as 'guardians of the truth', securing our geospatial heritage, and as ultimate 'decision arbiters'. The private sector develops, commercialises and innovates. These two need to be brought together – to cross fertilise – so that skills are shared rather than ring-fenced, and so that innovation is culturally embedded and translated into product. As the ODI points out, the car manufacturers have been busy working on 3D data for autonomous vehicles, independently of Government[54]. At some point, these two strands need to come together.

We agree entirely with what the ODI says:

> "Historically, geospatial policy has been fragmented across organisations stewarding key data assets, and implementation of the strategy has been reliant on collaboration. The creation of the Geospatial Commission in 2017 has brought the opportunity for change and collaboration will still need to play an important role."[55]

Private sector and commercial courses also suffer from the 'expectation gap'. We have already pointed out the close relationship between ICT and geospatial data. It is hard to envision why any

[53] https://kx.com/blog/kx-academia-carnegie-mellon-university-teaching-kdb/
[54] https://theodi.org/wp-content/uploads/2018/11/2018-11-ODI-Geospatial-data-infrastructure-paper.pdf Page 13.
[55] https://theodi.org/wp-content/uploads/2018/11/2018-11-ODI-Geospatial-data-infrastructure-paper.pdf Page 21.

modern educational discipline, particularly those aimed at corporate competency, would not include some technology component. Technology is part of our lives now.

The skills marketplace

This observation is founded in our own experience of delivering corporate training courses, to high level international executives. It has often struck us that there are major deficiencies in the UK skills base in software development, project management, contracting, implementation and understanding of information systems. This is evidenced in Public Accounts Committee reports and investigations of certain areas.

In recent months, it is noticeable that the take up of corporate training by the public sector and global companies throughout West Africa, Middle East and the Far East is escalating. From conversations with delegates, it seems that instead of being we are somewhat behind in our capability and thinking. For example:

- The Ghanaian Forestry Commission put RFID chips into tree logs, in order to monitor and prevent theft, which of course, relies on geospatial data. Currently our own Forestry Commission does not mention any RFID activity on its website;

As well as what has already been mentioned above, we suggest focus areas:

- **ICT expats:**
  Effective ICT (and therefore geospatial data capability) is a rare skill in the UK. In our experience, the best have ended up abroad. We should attract these people back to the UK to enrich our thought and development resource pool.
- **ICT strategy:**
  The 2011 strategy was recently updated, yet despite its avowed intention of 'greening government ICT' there is no mention of the role of geospatial data in addressing that.[56]
- **Data-centric procurement:**
  Procurement, specification and contracting still suffer from waterfall approaches even when opportunities are described as 'agile'. The roots of this lie in a tick-box approach to procurement, mostly driven by the need for financial accountability. This leads to compartmentalized specification and thinking. The ODI highlights the importance of linking data: "Identifiers are crucial to the process of sharing information. They are fundamentally important in being able to make connections between data, which puts them at the heart of how we create value from structured data." [57] If the Government is to create value, it has to link. The old Prince II and similar methodologies are fundamentally detrimental to this as they are big systems integrator/application centric not data-centric. A new data-centric procurement method is needed and should be paid for.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

[56] https://www.gov.uk/government/publications/greening-government-sustainable-technology-strategy-2020/the-greening-government-sustainable-technology-strategy-2020-sustainable-technology-for-sustainable-government
[57] https://theodi.org/article/white-paper-enhancing-open-data-with-identifiers/

Incorvus is actively seeking to identify specific geospatially-skilled talent as we foresee that, given the pervasiveness of geospatial data, this is likely to be an element of future projects. We are also intending to propose an InnovateUK project, so we are keen to boost geospatial skills in our organisation. It seems to us that these skills are scarce and in demand, so inevitably there is stiff competition for them where typically larger companies may seem more attractive for those who are career hungry.

- Are there any government incentives which might support recruitment to SMEs and therefore more rapid development of geospatial talent? SMEs typically offer a broader range of learning opportunities and this is also the sector where the most geospatial innovation is occurring.
- Where we have tried to work with academic institutions and some of the larger geospatial companies, we have been disappointed. Students do not have the expected levels of knowledge and larger companies seem somewhat disinterested in nurturing SMEs – perhaps they are too comfortable in what, up to now, has been a somewhat cosy marketplace?
- Are there any means to promote 'sibling' relationships between SMEs with acknowledged geospatial companies/universities/experts in order to spread the knowledge and experience more widely?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Boundary data for land or property we believe is one such area. Please see Appendix 1 for notes on this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data is not geospatial data *per se* and is only attributable to addressable properties. It does not include any unregistered land or any property/land that does not have an address – or sometimes a postcode. Currently, as ODI has extensively detailed the issues around address data. The primary one it seems to us is a licensing issue, to do with the current ownership of that dataset, which is now in the private domain (having previously been owned by the Royal Mail and therefore previously in the public domain). It would be extremely helpful for this to be released.

The Financial Times conducted a review of UK's patchy broadband network. A key task was to map the figures from 1.3m postcodes, data provided by industry regulator Ofcom on to 2.7m building outlines from Ordnance Survey." This survey produced really interesting results but they explain that although the OS data couldn't have been easier to access, the same was not true of postcode data. They were quoted more than £20,000 to use postcode polygons in their broadband map and ended having to do 10 days' worth of GIS effort to achieve the same result.[58] We believe this underlines why postcode data should be freely available under open licence since otherwise the owner of the data has a virtual monopoly, which is completely antithetic to the Commission's aims.

Creative Data reports (2015) give some idea of the value and application of postcode data, particularly in understanding social composition and profiles.[59]

Address data therefore is not open and not complete – it only includes addressable properties. Currently the UPRN number is linked to map data such as for local government purposes, however this is really a label of convenience (a foreign key in database terms), intended to provide each address with a unique point of reference. This of course is highly used by utilities companies, census takers, and political campaigners amongst others – and will tie in to electoral registers as eligible voters need to be linked to addresses within relevant jurisdictions.

Address data changes as property is built (new build) or developed (e.g. one house into several flats) but there are major inefficiencies down the chain if this data is not properly registered and utilities companies work from old or incomplete data when someone moves house. Better update mechanisms and standardisation at input are required. It would also be helpful if address data and UPRN's could more rigorously linked to geospatial boundary data, and tenant/ownership information.

[58] https://www.ft.com/content/f337e75a-b4df-11e8-bbc3-ccd7de085ffe
[59] http://www.creativepeopleplaces.org.uk/sites/default/files/Audience%20Agency%20Profiling%2C%20Year%202%20-%20National%20report.pdf

Figure 1: Battersea Power Station, Phase 3 development. Imagine if this was a point cloud...man cannot live by UPRN alone.

Again, the US sets the pace regarding emerging geospatial technologies and all of their evidence points to the need for scalability to meet increasing data volumes; and by implication bandwidth – to enable all that. An NGAC paper issued by the Federal Government[60] details the following overarching geospatial trends:

- **Real-time spatiotemporal data creation and interaction:** the report details this but in summary, it is the ability to interact (ingest and analyse on the fly) with this data in real time. This has specific technological requirements in ICT terms and we are aware of only one company with this technology at the current time. This requirement is similar to the real-time environment now so important to financial institutions and will apply particularly where there is satellite earth observation data in scope.
- **Minaturisation:** this is prevalent amongst IoT devices, such as sensors, and will increase the size and speed of the expected big data avalanche. This will place a premium on deciding what data needs to be captured; how devices are configured; how data is described in order to do that; and in our view, should encourage organisations to make provision for scalability that is off the scale[61], even if geospatial data currently is not thought to require this.
- **New mobile sensor proliferation:** Similarly to minaturisation, this will also create yet more data, and will enable individuals and the private sector to gather data.
- **Wireless and web network extension:** the UK is currently improving its infrastructure by laying fibre optic cable to upgrade to 5G (although completion is some way off according to those at the sharp end.) This will also bring additional impetus to data collection and will have

its own challenges when the regulator evaluates which spectra to allocate to which priorities. The geospatial community will have to make representations there in order to secure the bandwidth needed for the anticipated new growth in data and devices. The increased uptake in cloud, and in geospatial cloud, will need bandwidth provision.

- **Advances in computing speed and capacity for geospatial research and applications:** as stated previously, we are only aware of one technology vendor that can meet this test. This really is not the territory of the relational database.

It is interesting that the NGAC paper immediately moves on to consideration of ICT trends in the geospatial landscape, the point that Incorvus makes at the start of this submission, the intimate relationship between geospatial data and ICT. For them – and us – the key takeaways are:

- Data generation and collection;
- Data analytics (big data analytics);
- Infrastructure (goes to scalability);
- Access (granular permissioning and security).

To this list we would add the need for a data-centric approach supported by metadata and standardisation and data curation (lifecycle) in order to prevent data chaos – the more data you have the greater the size of the potential chaos.

One other point made by the ODI, and which will apply elsewhere, is with regard to identifiers:

> "When geospatial datasets are made open they should not be stripped of identifiers. It removes the ability for re-users to connect this data with other sources, and limits their ability to consume a mixture of open and licensed data via commercial services. Nor should they include only identifiers, and not supporting information, when registers for those identifiers are not open."[62]

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Collaborate with the specialist commercial companies working in those areas to align future development with foreseeable requirements e.g. metadata capability. Please also refer to the earlier KX space event comment. KX is already working in that area and has some of the answers.[63]

> "TELEMETRY
>
> - Data from satellites, ground segment and in-orbit may be used to identify faults, predict potential failures and plan maintenance. Sample use cases include:
> - Outlier Detection - Looking for faults within given parameters

[60] https://www.fgdc.gov/ngac/meetings/dec-2016/ngac-paper-emerging-technologies-and-the.pdf
[61] From research, Incorvus understands that whereas in 2020, 44 Zb was the expected generation of data worldwide, this figure is now anticipated to be in the region of 163 Zb by 2025. This significant change was noted recently - the estimation appears to have changed radically in the last year.
[62] https://theodi.org/wp-content/uploads/2018/11/2018-11-ODI-Geospatial-data-infrastructure-paper.pdf Page 38.
[63] https://kx.com/solutions/space/

- Alert Management Solutions - Data processing in real time allows immediate investigation and reduced response times
- Audit and Compliance - Ability to monitor health of fleet and governed by regulations on orbital spectrum
- Defect Tolerance - Finding mission critical defects in historical data to allow for defect monitoring and ability to perform remote analysis on ground segment / space based assets
- Historical Data Analysis - Cross comparison and correlation / pattern matching

SPACE SITUATIONAL AWARENESS

- Areas of application for Kx technology include Space Weather, Satellite Tracking & Monitoring and Near Earth Objects.
- Individual Asset: Real-time detection and alert management for changes in orbit, trajectory deviation and signal loss from individual space assets
- Fleet Level Management: Cross constellation monitoring asset health, failure detection and automates activation of redundancy measures
- Tracking and analyzing Space Debris data sets for risk mitigation and damage limitation

IN-ORBIT PROCESSING

- The amount of quality data gathered remotely by sensors that require harvesting and analysis is growing rapidly, meaning satellite operators require new methods to rapidly ingest, aggregate, inquire, compress and disseminate data from space-borne assets in order to fully exploit this new wealth of information. Kx for Space can be deployed in-orbit to provide a new range of on-board edge analytics and pre-processing solutions for space-borne assets and data.

ASTRONOMY AND ASTROPHYSICS

- The benefits of Kx extend to applications and use cases in astronomy and astrophysics by combining real-time and historical data in analytics.
- Real-time monitoring of assets with alert capabilities coupled with machine learning for predictive maintenance to drastically reduce costs and improve reliability
- Outlier detection in both sensor and observational data
- Historical data analysis and cross comparison on, for example, command & corresponding control messages beyond specified threshold limits."[64]

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

[64] https://kx.com/solutions/space/

Please refer to our response to Q5. We believe that the ICT is key here as this is the means by which we generate, capture and use geospatial data.

Until the data is of sufficient quality, and even then, Blockchain, which has acknowledged challenges[65] which also relate to interoperability and data quality, is not yet appropriate.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

By getting the data right: having a single unified map, with referential data integrity. Once the data is right, everything else (in our view) becomes possible. But a key part of getting the data right is using a data-centric approach to detail precisely what this means in real terms.

As an example, the big development at Battersea Power Station (to the right of the roadway) is extremely close to the Northern line extension work (to the left of the roadway). Both projects share areas of mutual concern, impacted by regulation. A digital geospatial resource could assist similar scenarios to be more proactively addressed.

Figure 2: Battersea Power Station development, boundary with Northern Line extension.

[65] https://www.sciencedirect.com/science/article/pii/S0167739X17329205

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Working with the private sector is essential to develop and capture skill at a national level. This will also pay off in terms of knowledge and research. Cross-fertilisation between public and private sector is important so that both gain knowledge, insight and experience. In the past, the public sector has tended to hand off a lot of responsibility to outsourcers and large systems integrators, which has led to a paucity of skills in the public sector and well-documented contractual and delivery issues (e.g. Carillion). The public sector has to learn to trust smaller companies – it was the mammals who innovated, not the dinosaurs!

Because this is an area of innovation, it would be good to see a culture of 'no-blame' fostered, instead of the usual 'safe' approach.

The public sector might successfully invest in geospatial data assets, through owners of data. Here the need for a "golden data record" infers a natural focus on OS (providing their remit constraint is lifted). This gives rise to the usual debate about the discontinuity between open data (free at the point of use) and the need for public sector to develop revenue from product. We suggest that OS data remain free, but that OS expertise remains billable from a professional services point of view. This should stay true to the Commission's aims as well as avoiding the monopoly prices that inhibit the rest of the market and stifle innovation.

Regarding further use, ODI's comments regarding identifier information are well made.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Mobile geospatial sensor platforms.

Smart data technologies are currently performing vital functions in the building industry. Smart devices not only measure and monitor automatically but also send out vital alerts when tolerances are exceeded. The one shown below is used to monitor for any significant movement in a massive retaining wall at the Battersea Power Station, Phase 3, development.

Figure 3: Monitoring ground shift in a massive retaining wall at Battersea Power Station.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a key role in helping the public sector move forward whilst at the same time, appreciating the public sector skills and knowledge base. In terms of infrastructure, we would advocate following the American model, where key providers such as ESRI, work closely with government as really trusted suppliers. The public sector can still fulfil its duties even if much of the service is delivered privately.

Incorvus sees public sector agencies as guardians of the truth, of the geospatial heritage. This places importance on the accuracy of the data, and related assurances. But the good news for the public sector is that the private sector, and private sector innovation, is in a position – thanks to emerging technologies – to assist with stubborn areas of exception where there is considerable need to enhance geospatial data assets. The public sector has enough to do as it is, so we believe that private initiatives in key areas should be a significant move forward, freeing public sector resources to expert work, building on expertise not routine.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The sooner HMLR is assisted to finish its current work to produce a digital register, the better. HMLR has approximately two-third of a billion paper documents, relating to title deeds. These are stored in Coventry, not in Plymouth where HMLR's HQ is. There is currently no intelligence available from these documents as the work of extracting information from them is the equivalent of searching for needles in haystacks. The text on these documents has to be screened and sifted by expert personnel. There is an acceptance that for some while, even once the digital register is completed, there will need to be a period of dual running as the new system is rolled out. Migrating data to the new system will be a daunting task.

Much of the answer to the second element of this question has already been provided by documents already released by the OGC, OS and ODI. These include detailed coverage of areas such as ontological and other standards. Interoperability is a 'must have'.

We are also aware of a lack of standardisation of approach at street level, amongst the various private utilities companies. This needs to be addressed and OS[66] has already made a good case for what sort of value this represents.

See how Indonesia, and its crowd, has solved some of these data conversion problems.

[66] 2.4._UK_Projects.pptx, Ordnance Survey.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By providing the leadership (and willpower) to ensure that key enablers like legislation, licensing and openness (in particular address data) and buy in from the civil service are all in place.

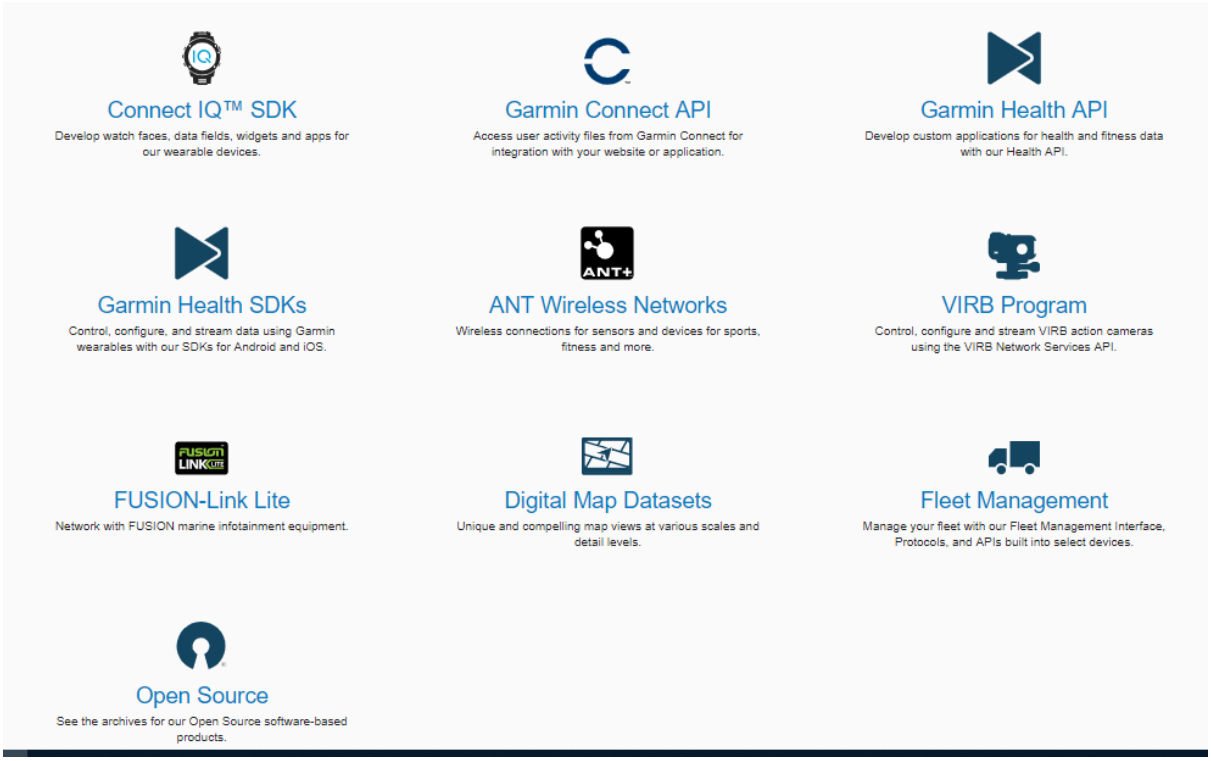
By allowing a more competitive marketplace than is currently in place in the public sector.

By being will to trust and innovate with a certain level of experimentation for new ideas. We are in uncharted territory.

By adopting exemplar practice (as opposed to starting totally from scratch) where the US, so far, appears to have the best systems approach to geospatial data that we have seen.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to: that might have novel and valuable use cases? What would that access look like?

GPS providers have considerable datasets (though we currently do not know what core data this is based on. See, for instance, Garmin. Garmin has global and national datasets.

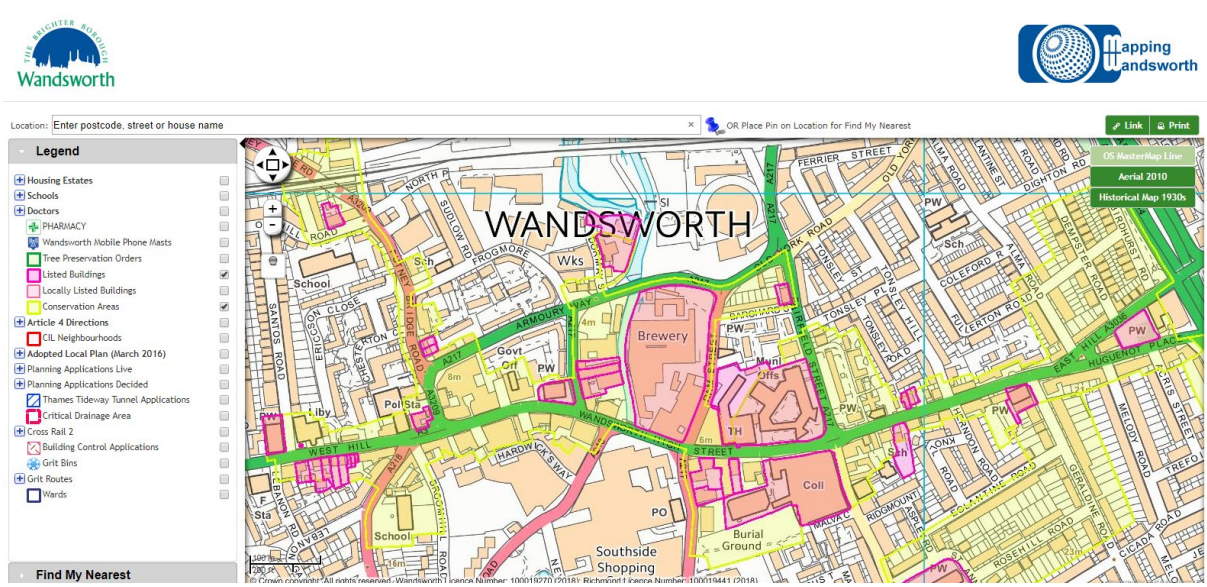


Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The planning application process takes no account of the ownership of the property or land affected by the application; nor does it involve the thorny issue of boundaries – much to the surprise of many applicants and objectors. Legal ownership, boundaries and party walls are not considered by local authorities during the application process, as these are classed as 'civil matters', for adjudication in a court of law. A number of other aspects that may have to be considered in the application process are; areas with special planning designations, such as Metropolitan Open Land (MOL), and Green Belt, etc. Also, properties may have special classifications such as 'Building of Townscape Merit', 'Listed Building' (national, 'Locally Listed Building' or be sited within or near to a Conservation Area. None of this information, vital in planning application considerations appear nationally within OS MasterMap. It appears to be only available and added locally as it pertains to planning within a particular council. Would it be useful if it were available nationally and possibly passed over to OS to include at a national level? Wandsworth Council (unlike Richmond Borough) uses the OS map data and presents it on their website – enriching it by overlaying it with planning, listed building, tree preservation orders and conservation area information. But once the map is moved beyond Wandsworth boundaries, the extra information is not present.

Hardly any information is available about what is underneath the sites or properties in question, which can be significant. The extent of flood plains and Areas of Natural Interest are not shown on the Wandsworth version of OS MasterMap, the consideration of which is part of the planning application process by that authority. An overlay of flood risk mapping (which we believe OS and the Environment Agency may have) would also be useful as this pertains to planning and other local authority issues.



Richmond Borough Council simply doesn't have this map at all on their website.[67]

The speed and accuracy of the planning application process has never been so vital, particularly as Government nationally and locally are pushing forward ambitious building programmes (especially new homes) in a time of increasing financial constraint. Many of the difficulties outlined above could be rectified by a consistent and authorised 'true' picture, created by compositing all of those layers of geospatial data into one coherent, researchable point of reference. This could be accessible by all interested parties. Given that there is such a variation of ability at local government level (a gap which is likely to increase as geospatial moves forward), perhaps one answer might be to pass some of this over to OS to form additional product?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

[67] https://www.richmond.gov.uk/search_results?qt=map

A lot of the value in these sectors is diluted by outmoded methods: e.g. the reliance on paper-based processes, fractured scoping and the amount of legal time and cost involved in disputes.

Figure 4: The iconic Battersea Power Station under development.

Battersea Power Station is a Grade II listed building, a major part of London's landscape, now being developed into a residential and commercial 'village'. The picture shows the site as it is now, in development, but fascinatingly, the developers have had the foresight to create a digital heritage trail:

> "Battersea Power Station is launching a new digital app to celebrate the history and heritage of the Grade II* listed building and its surroundings. The "Heritage Trail" app, which is free to download, explores the past, present and future of this iconic building as well as the wider transformation of this part of the capital into one of London's most exciting new destinations.
>
> Battersea Power Station, in partnership with leading digital agency Calvium, has created the app to bring to life the fascinating history surrounding this iconic building.
>
> The app, narrated by journalist and broadcaster Jonathan Freedland, guides visitors around Circus West Village, the first element of the regeneration to complete, and provides information, facts and insights into the Power Station's history over the years at key points around the area."[68]

The UK has a wealth of historical, archaeological and other interesting sites where similar explorations could be made. For example, HMLR has 150 years' worth of property registry data.

In relation to building and property, Ove Arup[69] has already identified the commercial benefits of digital build:

> "The property sector is on the verge of a huge leap forward in how it uses data-driven, digital products and services to make better decisions, construct better projects, and achieve better outcomes. Ubiquitous sensors, flexible and open IT systems and powerful cloud computing are creating more seamless and integrated experiences in many sectors. But property development often hasn't kept pace. For example, traditional project budgeting isn't yet aligned with the needs of a more integrated world. Costing processes fail to deliver the digital experiences that tenants or employees increasingly expect. And the balance of CAPEX and OPEX is changing as some previously fixed products become services with recurring costs and revenues. New thinking is needed."[70]

Q18: Are there any other areas that we should look at as a priority?

[68] https://batterseapowerstation.co.uk/news/article/heritage-trail-release
[69] https://www.arup.com/perspectives/publications/research/section/reimagining-property-in-a-digital-world
[70] https://www.arup.com/-/media/arup/files/publications/r/reimagining-property-in-a-digital-world-090317.pdf

It is our hope that the Commission will follow the model set in the USA: of fully open digital spatial data (including boundaries and taxable values), free at the point of use. The USA also uses a comprehensive ontology to address the need for consistency and interoperability across its various legislatures. In order to emulate this, the Commission has a vital role in ensuring that UK law is in place to enable this transformation (where currently it is not). The second key task is to encourage the crucial collaboration of key public sector stakeholders as the value of the open data relies on linking related data sources so they can be understood as a whole, not in part. The third essential priority, also learnt from the US experience, is the key role of private sector capability and thought leadership. The US relies heavily on expert companies, thus avoiding the continuing trap of large project IT failure in the UK.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Is it also worth considering the issue of regulation and in particular building regulations? Linking regulation to the geospatial environment in the longer term could provide a more cohesive picture for the multiple agencies involved in complex situations such as the recent Grenfell tragedy. We have divided up our regulatory landscape, and in the era of paper and analogue systems, that was adequate. Now the public has greater expectations and a glimmer of what is possible in the digital world. Maybe it is time to rethink how we approach complex multi-agency situations and perhaps use geospatial data/point clouds to generate a 3d model as the common touch point? For instance, the fire brigade could have access to 3d schematics which could show the location of gas pipes and other features, which might make their work easier and also enable closer collaboration between all relevant authorities. In the modern world, the aim should be connectedness.

1Spatial[71] takes a rules-based approach to utilities, e.g. the solution they have provided to Northern Gas Networks. The rules regarding placement and size of notices; safety areas around holes and utilities works and other processes, are part of the overall ICT solution. This is more efficient and realistic than requiring operatives to work with extremely large regulatory documents of biblical proportions every time they dig a hole; and reduces the possibility of error or oversight.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

[71] https://uk.webfg.com/news/aim-bulletin/northern-gas-networks-awards-significant-contract-to-1spatial--2852375.html

By having an approach to spatial data that is world-leading. Currently we are behind even the small island nations of the Caribbean, encumbered by legislation and a philosophy that is retrospective.

We will also need 5G in place and from talking to street operatives, we understand full rollout may be some years away….

Perhaps the work of OS and similar agencies is somewhat undersold, and needs to better appreciated, particularly in the UK! We seem to have lost the excitement somewhere as this now seems to reside with the private sector. We believe there is a need to raise awareness of what is special and exciting about geospatial data and are ourselves considering writing a paper on this to explore further some of the points made in this response.

We trust that the vision for the Geospatial Committee itself is broadly in keeping with the US model:

> "The National Geospatial Advisory Committee (NGAC) received guidance from the Federal Geographic Data Committee (FGDC) in 2016 to provide perspectives and advice on how new technologies will impact the geospatial community. This report examines new and emerging technologies that will be of importance to Federal Government agencies using geospatial data, in the near- and medium-term future (~5 year horizon). The report identifies five overarching technology trends driving geospatial technologies, and then examines within this context the impacts on federal agencies in the core geospatial activity areas of data collection and generation, data analytics, infrastructure, access, and workforce."[72]

There should be an overarching body to lead national work in this area for some time to come – and possibly in the longer term too. We cannot foresee what all the regulatory challenges may be yet, but we know they are there, so the Commission is best placed to fight those battles.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The USA model would be an excellent place to start. Their data is open. OGC has a really great project in Manhattan, discovering and detailing the built underground infrastructure[73].

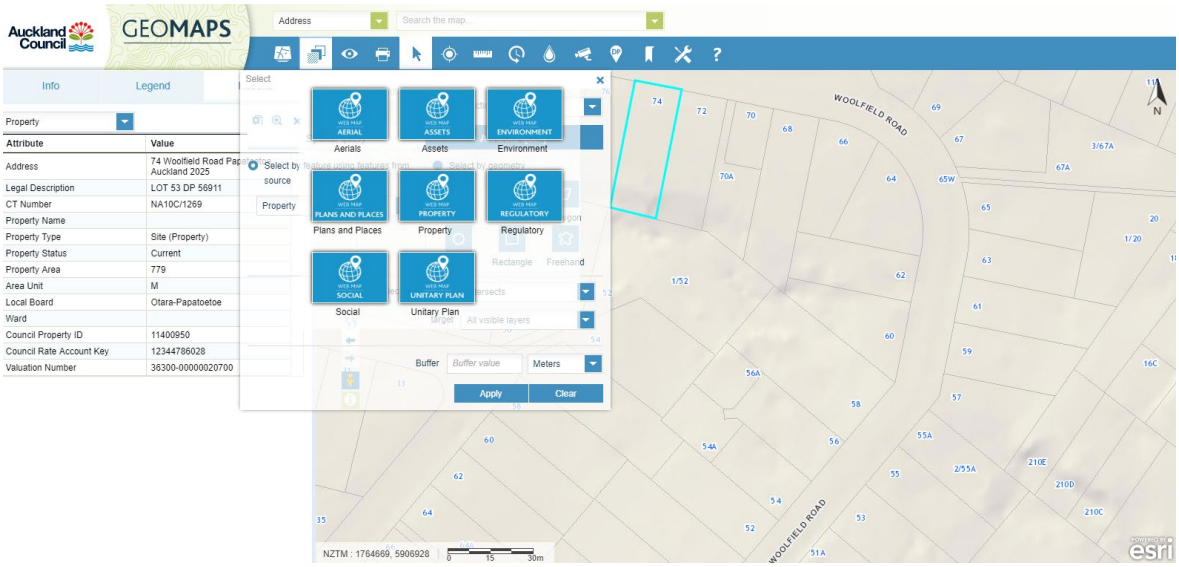
Palo Alto is a great exemplar of how locational data can solve urban problems!

The OGC regards Flanders and Auckland as exemplars of what can be achieved with geospatial mapping.

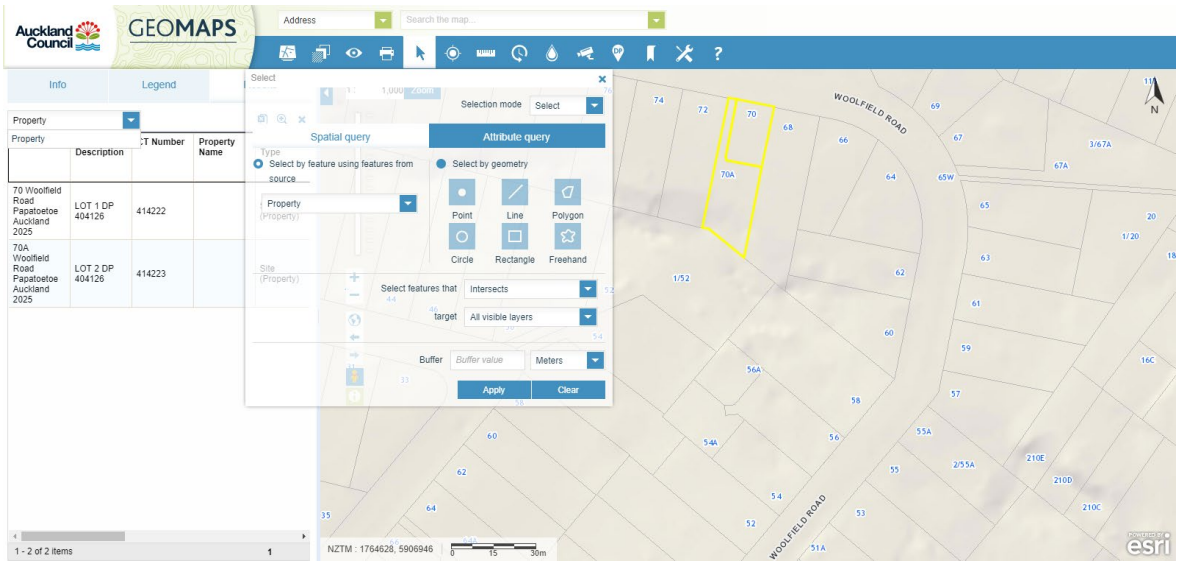
[72] https://www.fgdc.gov/ngac/meetings/dec-2016/ngac-paper-emerging-technologies-and-the.pdf Page 1.
[73] http://www.opengeospatial.org/projects/initiatives/ugipilot

The Flanders[74] portal KLIP[75] appears to be no longer in public sector ownership and as a result it is no longer possible to determine what exactly is there – however one can see that they are clearly working with a number of utilities companies as regards the built underground.

The Auckland[76] map, based on ESRI technology, is integrated:



and links ownership data to land parcels, property, topology, flood risk and other datasets:

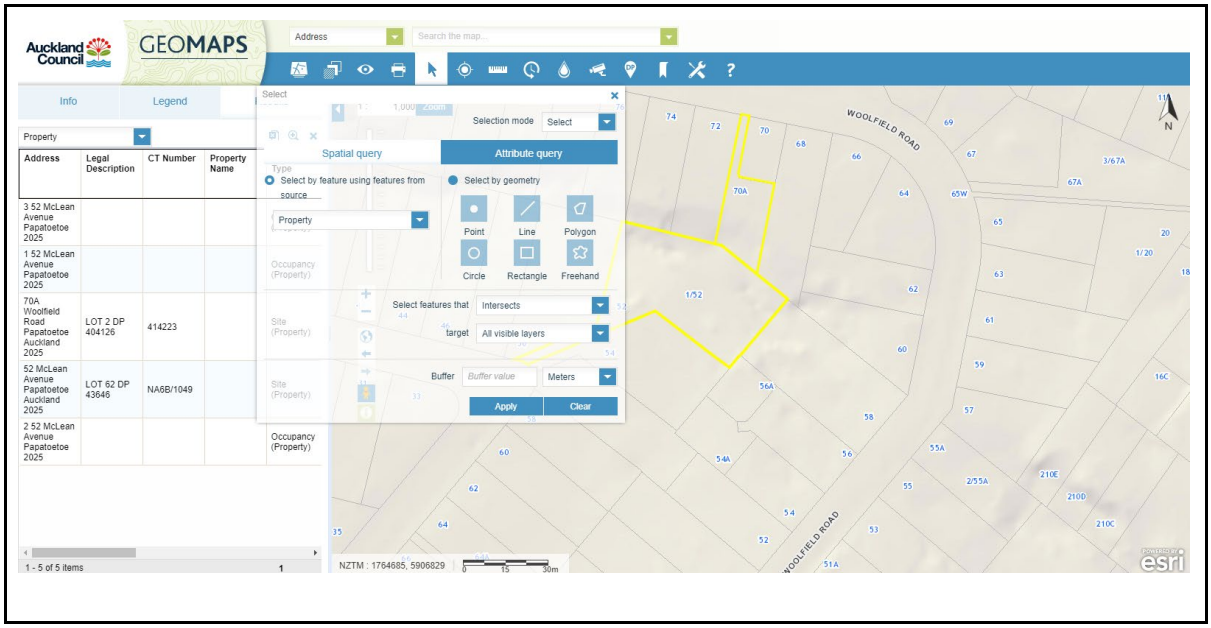


by point, line, polygon, rectangle, freehand, circle etc., as well as providing coordinates, taxable values and other property address information.

74
https://auth.vlaanderen.be/sts/?wa=wsignin1.0&wtrealm=urn%3ainformatievlaanderen.be%2foauth&wctx=rm%3d0%26id%3dpassive%26ru%3d%252fauthorization%252fws%252foauth%252fv2%252fauthorization%253fresponse_type%253dtoken%2526client_id%253d692%2526redirect_uri%253dhttps%253a%252f%252fklip.vlaanderen.be%2526scope%253dMapRequestInitiator%252520MapRequestReader%252520UnaOperator%252520UnaReader%252520PrivateKlipApi%252520KLIPHelpdesk%2526state%253d&wct=2018-12-24T12%3a26%3a24Z&wreply=https%3a%2f%2foauth.vlaanderen.be%2fauthorization%2f

75 https://klip.beta.agiv.be/

76 https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html



Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Appendix 1: Boundary Data

HM Land Registry

HMLR describes its purpose as being to "register the ownership of land and property in England and Wales". It goes on to say:

> "HM Land Registry safeguards land and property ownership worth in excess of £4 trillion, including around £1 trillion of mortgages. The Land Register contains more than 25 million titles showing evidence of ownership for more than 86% of the land mass of England and Wales."
>
> Anyone buying or selling land or property, or taking out a mortgage, must apply to us to register:
>
> - unregistered land or property
> - any new owner of registered land or property
> - an interest affecting registered land or property, such as a mortgage, a lease or a right of way
>
> When considering each application, we use the law to decide whether and how it should be registered.
>
> …..Once land or property is entered in the register, we record any ownership changes, mortgages or leases that affect it. Anyone who suffers loss because of an error or omission in the register, or because the register needs to be corrected, will normally be compensated.
>
> ...We are a [non-ministerial] government department created in 1862. We operate as an executive agency and a trading fund. Our running costs are covered by the fees paid by the users of our services.
>
> Within England and Wales, our responsibilities are:
>
> - to provide a reliable record of information about ownership of and interests affecting land and property
> - to provide owners with a land title, guaranteed by the government
> - to provide a title plan that indicates general boundaries
>
> We do not provide legal advice on precise boundary positions and responsibilities.
>
> ...Our ambition is to become the world's leading land registry for speed, simplicity and an open approach to data.
>
> Our mission is: "Your land and property rights: guaranteed and protected"."

From reviewing HMLR's own commentary on boundaries, they bluntly state: "If you live in England or Wales, there's usually no record of the exact boundary between two properties; or, who owns the hedge, wall, tree or fence between 2 properties". (Different rules apply in NI and Scotland).

They also state:

> "You can get an idea of where the boundaries for your property are by looking at its title plan. Most title plans don't show exact boundaries - you usually don't need to have the exact boundaries recorded anywhere."

If the title plan is incorrect, it is possible to apply to HMLR to have it corrected. And they say it is possible to record the boundary more precisely by either reaching an agreement with your

neighbour (tick) or by applying for a determined boundary. However on HMLR's blog, the commentary from those who have fallen foul of the system highlights the misery that boundary issues provoke. The propose panacea of applying for a determined boundary is really a means by which HMLR is trying to push the work onto its clients, understandable, but a stark comparison with the system prevalent in the US where all data is publicly and freely available from any town hall. The panacea also relies heavily on good neighbours rather than any empirical, measurable fact - a tolerance

Ordnance Survey

OS describes itself as follows:

> "We are the national mapping agency of Great Britain and the government department responsible for the official, definitive surveying and topographic mapping of Great Britain.
>
> As Ordnance Survey maps are topographic maps, they only show the physical features on the ground at the time of survey. The features shown must fall within the specification for the survey scale and within the published accuracy tolerances.
>
> Ordnance Survey maps never show legal property boundaries, nor do they show ownership of physical features. Although some property boundaries may be coincident with surveyed map features, no assumptions should be made in these instances and consequently it is not possible to be sure of the position of a legal property boundary from an Ordnance Survey map.
>
> HM Land Registry uses Ordnance Survey mapping to provide a representation of where a property's boundaries are located.
>
> For example, if no physical feature (such as a wall, fence) exists on the ground to separate two gardens, nothing will be shown on Ordnance Survey mapping. However, in order for a boundary to be represented on a Title Plan, HM Land Registry will indicate extent of the property with a red line. HM Land Registry will show the extent of the land in a registered title by a red line on the title plan. Where a boundary of the land is not defined by a physical feature on the Ordnance Survey map, HM Land Registry indicates it on the title plan by a dotted line.
>
> A red line on a title plan drawn by HM Land Registry does not mean that a dividing feature exists on the ground. Similarly the absence of a dividing feature on the Ordnance Survey mapping does not mean that information is missing from the Ordnance Survey map or that the title plan supplied by HM Land Registry is incorrect.
>
> Remember that the title plan only shows the features that existed at the time the property was surveyed. Fencing removed or added later will not be shown.
>
> Ordnance Survey has a continuous mapping revision programme for the whole of Great Britain. Changes that have occurred on the ground since the property was registered may result in differences between later Ordnance Survey map editions and the mapping used by HM Land Registry for the Title Plan."

OS goes on to say, in relation to HMLR:

> "We and HM Land Registry work in very close partnership. Land Registry cross-references and associates their boundary information with our topographic maps as the basis of all Land Registry title plans."

OS then supplies the answers, jointly prepared by itself and HMLR, in response to boundary questions, and to elucidate the roles of the two bodies:

> "**HM Land Registry's role**
> HM Land Registry will show the extent of the land in a registered title by a red line on the title plan. Where a boundary of the land is not defined by a physical feature on the Ordnance Survey map, HM Land Registry indicates it on the title plan by a dotted line. The word "boundary" has no special meaning in law but in land ownership it is understood in two ways:
>
> **The physical boundary:**
> A registered title almost never shows ownership of individual boundary structures such as walls, fences and hedges. There may, however, be some relevant information on the register or in HM Land Registry's files. For example, HM Land Registry may have kept a copy of a deed that refers to a boundary declaration or agreement, or to the ownership or maintenance of boundaries. Please note that deeds rarely deal with such matters.
>
> If ownership or maintenance is important to you, you may, for example, need to talk to neighbours and/or previous owners. We cannot provide information on either property extent or land ownership.
>
> **The legal boundary:**
> A legal boundary deals with the precise separation of ownership of land. It is an invisible line dividing one person's land from another's. It does not have thickness or width and usually, but not always, falls somewhere in or along a physical boundary feature such as a wall, fence or hedge. The exact positions of the legal boundaries are almost never shown on registered title plans and are not shown on Ordnance Survey maps.
>
> **General boundaries**
> England and Wales operates a 'general boundaries' system of land registration. A title plan with 'general boundaries' shows the boundary of a property in relation to a given physical feature on the ground such as a wall or hedge as identified on the Ordnance Survey map.
>
> The red edging on a HM Land Registry title plan is therefore not definitive as to the precise position of the boundaries. For this reason official copies of title plans carry the following warning.
>
> *This title plan shows the general position of the boundaries: it does not show the exact line of the boundaries. Measurements scaled from this plan may not match measurements between the same points on the ground.*
>
> This is a clear statement that HM Land Registry is unable to tell you precisely where a property boundary is located."

OS is limited by an Act of Parliament from the 1840's and is not allowed to show property boundaries.

Local Government

Local government (sic Councils) are not partners in the GC however they are the intended beneficiaries in terms of service improvements and efficiencies. Operation and rules vary widely from council to council - they can be everything and nothing - but here is what Hastings Council says:

"**Planning - Land Ownership and Boundary Disputes: General Advice**
Planning Services do not hold records of land ownership. We are also not able to tell you who is responsible for a particular boundary or provide legal advice on boundary disputes.

Initially you should check the deeds to your property. If the property is mortgaged the deeds will be held by the building society or bank. They may charge a fee for retrieving the deeds from their archives. The deeds should include a plan defining the boundary of your property, with "T" marks on the boundaries. Where the tail of the T extends into your property you would normally be responsible for that boundary. However, if there is a dispute over land ownership or a particular boundary you should always seek legal advice.

The Land Registry hold information on land ownership and produce information relating to boundary disputes. Please visit their website for more information."

Other research **sources**

1. Written in 2005 – not much has changed….
https://www.theguardian.com/money/2005/oct/16/property.observercashsection

2. This is current – detailing everything that relates to disputes, including required data etc.
https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/building-surveying/boundaries-procedures-for-boundary-identification-demarcation-and-dispute-resolution-3rd-edition-rics.pdf

a) also: https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/regulation/drs/toolkit/boundary-disputes.pdf

b) and: https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/regulation/drs/toolkit/construction-disputes.pdf

3. The legal process: https://www.judiciary.uk/about-the-judiciary/the-justice-system/jurisdictions/civil-jurisdiction/ from top to bottom. The courts are not keen on adjudicating on boundary disputes: http://ascotlawyers.co.uk/news/1827-boundary-disputes-a-warning-from-the-courts.html

4. And another area of benefit would be in countering fraudulent land claims:
http://ascotlawyers.co.uk/news/1827-boundary-disputes-a-warning-from-the-courts.html
and in relation to vacant properties potentially: https://www.bbc.co.uk/news/uk-42536418

5. Evidence in boundary disputes relies on aerial photography https://ncap.org.uk/case-studies/boundary-disputes

6. The Government tried to reduce incidence of disputes in relation to boundaries via a new bill introduced in 2017 but this stalled: https://www.blakemorgan.co.uk/training-knowledge/features-and-articles/boundary-disputes-be-overhauled/ . This is a more current write up on it: https://www.lawgazette.co.uk/features/insight-will-parliament-draw-a-line-under-boundary-disputes/5064529.article It's a private member's bill so unlikely in the current circumstances to go much further.

7. Boundary disputes can be a nightmare for all concerned. ... Traditionally 12 years were required to establish adverse possession … https://www.andersonrowntree.co.uk/journal/stepping-over-line-%E2%80%93-managing-boundary-disputes This is what the government says: https://www.gov.uk/your-property-boundaries

8. This 2005 article spells out some of the legal considerations, technical aspects (e.g. measurement) and the law's view on OS and HMLR data. Time has overtaken it but the principles still hold good. (See also relevant excerpt below in italics). This article helpfully details the business case but this too has been overtaken by time…) https://www.fig.net/resources/monthly_articles/2005/february_2005/powell_february_2005.pdf

Excerpt relating to item 8

"In England & Wales there are two systems of land ownership records that sit side by side. The first is the rather old-fashioned "deed" system which involves conveyances, indentures, deeds of gift, etc. these are the bits of paper that describe one's legal ownership of a property. Every property in England & Wales has such a document and those documents often include measurements (usually in imperial units) and detailed descriptions. The measurements are usually qualified somewhat by phrases such as "a little more, a little less", "or thereabouts" or "approximately". All of which throw another form of vagueness into the problem. Of the 21,000,000 properties in England & Wales, about 17,000,000 (81%) are also registered with Her Majesty's Land Registry. However, if a boundary dispute goes to Court, the LR data is not usually considered by the Judge. The reason for this are that LR Title Plans are based on OS (Ordnance Survey) maps and are therefore approximate only. Such maps are not intended to be scaled from and measurements taken from them can only be considered to be accurate to 1 metre at best. As most boundary disputes involve just a few centimetres, it can be seen that the LR Title Plans are no more useful than a location plan, which is exactly what they are. The object of LR in England & Wales is to create and maintain a "register" and the plan or map that comes with it is for general identification purposes only. This is underlined by the General Boundaries Rule of LR which describes how a line on a LR Title Plan can represent a hedge, a ditch, a wall or a fence or any part thereof or be parallel to the legal boundary. It is the legal boundary (not the extent of registered title) that the boundary surveyor must look for. An interpretation of the text of a deed is one for a lawyer to make but it is quite in order for a surveyor to flag-up various parts of the text for a lawyer to add an interpretation to. The deed plan, however, is in the realm of the surveyor and it is this plan that must first be compared with what exists on the ground. There may well be "T" marks

against some of the boundaries on the deed plan and this usually (but not always) indicates that the person with the "T" facing inwards has the responsibility of erecting and thereafter maintaining a boundary feature within their own property."

"CONCLUSION WITH REFERENCE TO SURVEYOR'S WORLDWIDE

1. The sort of work that is described in this article may well be unique, in terms of quantity, frequency and intensity, to England and Wales.

2. There is no doubt in my mind that the introduction of a cadastral system of boundary records in England and Wales would eliminate a large proportion of these boundary disputes.

3. The main problem that prevents the installation of a blanket cadastral system over all 21,000,000 properties in England and Wales is the cost. It is estimated, by lawyers and myself, that it would cost something like £2,000 per property to get a system into place. After the initial installation, of course, operation of a cadastral system would be simpler and it would be cheap to update as the years go by. The initial cost (21,000,000 X £2,000)" which would, presumably, have to be met by the UK taxpayer, is such that no politician is likely to campaign for the installation of a cadastral system in England and Wales!*

4. It is my opinion that a better way of introducing a cadastral system into England and Wales would be to make it mandatory on new housing estates. This would involve a cost that I estimate as being £200 per property. As the average cost of a house on a new housing estate is c£180,000, this amounts to 0.1% which is, in my opinion, a price that could be "hidden" within the cost of the new home.

5. I am aware, from my travels to mainland Europe and to the Caribbean, that boundary disputes occur even where a full and efficient cadastral system exists. However, it seems, from what I have seen and heard, that those disputes are infrequent and do not involve the cost and intensity of those in England and Wales.

9. Boundary disputes very costly: an access dispute cost £200,000 virtually bankrupting one party.

10. HMLR's statement on boundaries: https://hmlandregistry.blog.gov.uk/2018/02/27/drawing-the-line-on-boundaries/ Note the length and substance of the comments from aggrieved land and property owners, who do not appreciate why HMLR is not responsible for boundaries, just title deeds!!**

11. Ordnance Survey's statement on boundaries: https://www.ordnancesurvey.co.uk/resources/property-boundaries-owners.html OS is limited by an Act of Parliament from the 1840's and is not allowed to show property boundaries!!**

12. ONS data on UK property: https://www.ons.gov.uk/peoplepopulationandcommunity/housing

13. http://www.boundary-problems.co.uk/boundary-problems/titleplans.html This page sets out the issues around boundary data from the perspective of the UK citizen.

*There are now 25m properties in the UK.

** Land Registry is required by Section 60 of the Land Registration Act, 2002 to show only the general position of a boundary. Section 12 of the Ordnance Survey Act, 1841 decrees that Ordnance Survey maps "shall not extend, or be deemed or be construed to extend, to ascertain, define, alter, enlarge, increase or decrease, nor in any way to affect, any Boundary or Boundaries of .... any Land or Property".

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Individual response
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Media**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Your view is accurate but you could add a distinction between 'passive' data, for example a map, and 'active' data for example GNSS data tracking a vehicle.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There is a need to develp skills and awareness at all levels: schools, FE, HE and particularly to initiate conversion courses so that people trained in other disciplines, such as computer science, engineering, etc., can understand the utility and context of geospatial data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Not applicable.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There are many data sets which are not easy to access or use, for example data from local authorities, particularly those involved in developing smart cities, which are not interoperable, which couldbe useful. Similarly data from crowd sourcing. The accuracy of data sets such as Google maps is variable and not well specified.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A key requirement is to raise awareness of the availability and characteristics of geospatial data to all sectors of government and business. Interoperability is obviously a necessity as is the imposition of standards. An example of the problem is BIM, and the need to make BIM convenient for use for quantity surveying and facility management.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Free and open data has greatly extended the use of EO data, proven through the increased use of Landsat and Sentinel data. This can be reinforced by platforms in the cloud which enable processing and image analytics for non specialist users. Collaboration with companies such as Earth-i and DigitalGlobe would help extend the use of EO data.
Large volumes of EO data are now available covering a very wide range of applications. High resolution commercial data is available at cost, as is lower accuracy high revisit data. The Commission could investigate whether UK should invest in such systems for UK applications.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Obviously AI and machine learning.
Rapid access to accurate GNSS data, possibly through mobile phones.
Platforms in the cloud.
Wider access and understanding of BIM.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Promotion of new applications, for example greater exposure of the Geovation hub and the start ups initiated there.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Collaboration is the key here. The benefits of joined up government using geospatial data should be obvious and this should be extended from central government to local government.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Ordnance Survey provides an excellent infrastructure through, for example, OS Net and Mastermap, and these must be supported through continued access to GNSS, especially Galileo. This needs to be refined to meet the demands of CAVs. An infrastructure for indoor mapping is also needed. If more services available to mobile phones are to be developed positioning capability needs to be ubiquitous and reliable.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Acceptance and implementation of standards is essential.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Not applicable.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Transport data.
Crowd sourced data.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Extension of services for land and property such as QS, valuation, estate agency. Data on transport, road and rail to make these services more efficient.
There is scope for improved targetting for sales and marketing through more efficient use of traffic data (vehicle and pedestrian) around billboards.
Siting of solar panels on residential property could be extended.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous vehicles and smart cities are obvious examples but the projects at the Geovation Hub indicate that there are many, at present unthought of applications, which could be developed.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

UK is represented at fora such as UN-GGIM, CEOS, EuroSDR and international learned societies such as FIG, ISPRS, ICA, IAG and has good visibility. These contacts should be continued and promoted.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The main contries which came to mind are Australia (PSMA), Singapore (SLA), China, Netherlands.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Wednesday, 24th October 2019

Geospatial Commission - Response to the Call for Evidence

Dear Geospatial Commission

I write in a personal capacity concerning the field of Civil Contingencies and Resilience. The views expressed here are my own and this submission does NOT represent, nor is it part of, the official view and response of my employer.

The primary purpose of Emergency Planning is where possible to prevent major incidents and emergencies occurring in the first place. When they do occur, effective planning should reduce, control or mitigate the effects of the incident or emergency.

Civil Contingencies work is underpinned by a series of legislation. Each risk requires a plan to be developed and an essential component of these plans is geospatial information and mapping which are required at the i) planning, ii) response and iii) recovery phases.

Geospatial information is essential at the planning stage to analyse, identify and communicate risk between stakeholders and is the only effective means to build a holistic picture, exposing adjacent multiple risks and their potential concomitant impacts.

In response to a major incident or emergency, geospatial information is essential for shared situational awareness (SSA) and informing a common operating picture (COP). It is key to understanding the current situation and consideration how to mitigate and response to potential further risks and impacts. It enables rapid decision making at Strategic, Tactical and Operational levels and is used in a coordination context at national (COBR (Civil Contingencies Secretariat / National Security Secretariat)) and local (Local Resilience Forums/Local Resilience Partnerships) as well as by individual Category 1 and Category 2 responder organisations.

During the recovery phase, which can often be extended e.g. major flooding or infectious animal diseases, geospatial information is critical to organising the planning and execution of the recovery task as well as prioritising the areas where the recovery effort needs to focus and in providing an importance evidence base for compensation purposes, where applicable.

Relevant legislation includes;

Civil Contingencies Act 2004

Civil Aviation Regulations

COMAH – Control of Major Accident Hazard Regulations 2015

Flood and Water Management Act - 2010

Maritime Legislation (Coastal Pollution / Off-Shore Incidents)

Pipeline Safety Regulations 1996

REPPIR – Radiation Emergency Preparedness and Public Information Regulations 2001

For each plan there is a requirement for supporting geospatial information and mapping. This essentially has two key components i) a set of thematic information relating to the risks within the scope of each plan and ii) access to current and detailed nationally available topographic mapping, address, terrain (height), transport network, imagery etc. data such as is provided by the National Mapping Agency. In practice these are interdependent; much of i) can be created or derived through the analysis of ii) and, in-turn ii) is required in order to interpret and visualise i). My response to the Call for Evidence is focussed on the former (i - thematic information) rather than the latter (ii – national mapping data) of these ii components.

As part of this planning process, best practice is to use a vulnerability assessment checklist to identify vulnerabilities within the risk area and to make this available geospatially. This information is then used to prioritise resources during a response and ultimately protect life and property. Recent high-profile incidents, such as the 2015 floods in the north of England, have emphasised the need to have access to 'data' from a trusted source to support the situational awareness.

Based upon my experience while working in the resilience field at the UK Government, Devolved Government and at Local Resilience Forum/Partnership level for over ten years it is clear to me that the provision of and access to the thematic risk and emergency planning data is insufficient and is not nationally consistent.

My experience in providing geospatial support during major exercises, major planned events (such as London 2012) and major incidents has demonstrated that critical geospatial information often does not exist 'digitally'. For example, the information may exist 'locked' in maps in PDF format, but this is not 'useable' within geographical information processing technology without significant re-processing which is not desirable, and in some cases, not possible during a major incident response. When time is critical this is a real risk to life, critical infrastructure, industrial assets and property. There is currently no national standard for the creation of such datasets and therefore it is difficult to obtain national datasets, this impedes; cross-LRF working, provision of mutual aid, assistance from national agencies and the formation of a national level government overview. Where data does exist 'digitally' it is often not in formats that we would consider immediately useable in geospatially enabled environment, for example the information may be spread across multiple files which require joining together, and/or may exist in formats such as ASCII, CSV, DWG or perhaps proprietary, binary or scientific format. Also the quality of data can be highly variable in terms of its spatial resolution, the level of attribution, level of completeness and spatial coherence and fidelity with other mapped features.

There is an opportunity for the Geospatial Commission to provide strategic direction and leadership towards the creation and maintenance of nationally consistent, fit-for-purpose and accessible resilience datasets. The key issues that need to be addressed are:

- Overall strategic approach e.g. best practice, mandatory etc.
- Funding of initial creation and long-term maintenance
- Governance and national coordination
- Stakeholder mapping - organisations, roles and responsibilities
- Definition of list of the risks for which geospatial data is required
- Definition of the set of geospatial data required for each risk
- Creation of nationally agreed data standards – geometry, attribution and metadata
- Definition of nationally agreed data formats – must be 'useable'

- Definition of provision of data as a set of services
- Agreement on currency and maintenance regime
- Agreement on data sharing and access control issues
- Familiarisation amongst resilience professionals of data sets available
- Training in the use of geospatial information processing technology for resilience purposes

The issues faced in the resilience space are similar to those that we face in bringing together national datasets of utility, energy and infrastructure information. Whilst I do not underestimate the significant amount of work required to achieve the desired state, I note that most of the data required for resilience purposes is produced by public bodies, and with wise leadership we should as a community acting in a coordinated manner be able to make relatively quick progress.

By way of an early example case study it would be insightful for the Commission to look into the review that DEFRA are currently undertaking into multi agency flood plans. DEFRA guidance encourages completion of flood risk summary sheets for each flood warning area. It identifies the types of required information such as care homes, schools, camping and caravan sites, all of these are geospatial in nature.

[Text redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Individual response
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X but work in the spatial industry**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I feel there is data out there which has a spatial element (it can be 'geo-enabled) but is not specific geographic data. I would include within this a whole raft of government statistical data which could be viewd spatially but viewing it geographically is not it's primary purpose.
I would include as part of this data unemployment rates, uptake of National Insurance Cards, emissions to hospitals etc etc.

I would call this Statistical Data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I feel the Geospatial Commission should provide a framework for organisations, specifically government to be able to realise the benefit of GI easily – e.g.
1 A Governmnet Statistical Web Map Service – to make it easy to view and examine government data spatially. With no or low GIS skills.

2 A government wide Address Matching Service which appends the UPRN to Government data. Various gov. departments are building their own services e.g. DVLA, HMRC, Cabinet Office, ONS. Surely government should have one Address Matching and Cleansing Service for the use of the whole of government.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Main gaps again within government is that there is no Government wide Address Matching and Cleansing Service. This make so much sense, economies of scale, using the same address data, using a common address id (UPRN) across government, improving the sharing of data across government.

Individual departments are building their own solutions.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Releasing Land Registry data to the masses would provide I feel economic benefit within the property sector.

Making PAF available for free.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Again we need consistent address data. AddressBase does not necessarily answer the total question. It has discrepancies between the Royal Mail and Local Authority addresses. This data needs to be linked to map data.

Driverliess cars – if an address is matched to a road then the car can find the address on the road. This needs to be consistent.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Providing the ability to easily 'geo-enable' non geographic data in a consistent manor for private and publics organisations. This could be a web service.

Provide data through the cloud is an easily useable format e.g. web map service or web feature service.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Data is not consistent. It is not easy to use. It is hard for non GI literate people to use. Data has to be matched.

Using common standards would make it easier to use. For example if you are mapping statistical data with Ordnance Survey data are be boundary names consistent? Are the called the same thing. A lot of time is spent getting data ready before being able to analyse it.

If government statistical data used common boundary names across government, was already geo-enabled (able to easily map it) it would save a lot of time and effort.
Improved 'Meta Data' (information about the data) would also help. Using common standards.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Ensure commons standards are used. EG Common Address Matching Service across government for address matching and cleansing and for appending a common id to addresses (UPRN).

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**

- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I think the definition for "geospatial identifiers" is too narrow. Many geospatial identifiers are also useful for linking geospatial data to datasets that have no location component themselves, rather than merely linking to "positional data".

The other definitions are fine but this typology is likely to be of limited use for thinking about geospatial data in depth; it may help to develop a more detailed glossary.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Development of geospatial skills may not be an area that requires any significant intervention from the Commission – that should be validated. There's always room for improvement in building data literacy and IT literacy in schools and among the general public, and geospatial skills should remain part of that effort. However I haven't perceived any real lack of skills capacity in the geospatial sector that isn't addressed by existing availability of training.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As I'm submitting this response in a personal capacity, I have no answer on organisational needs and gaps. (My current employer may make their own submission.)

I don't know how much strategic benefit there is in promoting careers in the geospatial "sector" per se. Geospatial is a collection of technologies, which have suppliers, and there are careers there. However the real focus should be on the sectors where geospatial data and technology have useful applications. These will have highly varied interests, so the best approach is to demonstrate the utility of geospatial skills in a variety of job roles and contexts.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

As an open data activist I have a long list of geospatial datasets that I don't think are sufficiently open for access or use. These are a few specific examples:

Flood data. EA made progress a few years ago by releasing its Risk of Flooding from Rivers and Sea (RoFRS) and Flood Map for Planning datasets as open data. However surface water and combined flood risk datasets remain available only on more restricted terms. This creates information asymmetries between consumers and business in understanding flood risk, particularly in conveyancing and in household insurance (where the proprietary data model used by Flood Re is also a barrier).

Land ownership and use. Very little of Land Registry's spatial data is open and the picture in Scotland is even worse. The Rural Land Register is also largely inaccessible. The Commission should revisit the 2017 housing white paper and make transparency of land ownership and interests a strong focus of the strategy.

VOA data remains difficult to access in bulk, especially that related to business rates and floor space. VOA recently and unexpectedly decided not to continue publishing annual small-area statistics on council tax bands and build periods; this reduction in transparency makes little sense given the level of public interest in the state of the housing market.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The current address data "ecosystem" is poorly adapted to support established technologies, let alone emerging technologies.

I don't have any real criticisms of the technical quality of the authoritative bulk address dataset (OS AddressBase), or the GeoPlace system in place for managing the collection and collation process.

However AddressBase is drastically underused in consumer-facing applications (i.e. on the web) due to licensing costs and the investment in security required to comply with restrictions on use.

Beyond the many uses for address data that can only be supported by open licensing, the main benefit from unlocking national address data is likely to be improvements in the quality of the thousands of smaller address datasets collected and maintained by individual organisations.

Currently, cleansing an organisation's own address data (such as a customer list) against AddressBase or PAF represents an input cost as well as a "derived data" risk for the organisation. Organisations tend to only use these datasets to improve the quality of their address data when they have a business case for doing so.

This problem is evident in infrastructure datasets such as the Companies House Register and Land Registry's Price Paid Data, but also affects the quality of thousands of mailing lists, lookup tables, and other address datasets maintained by businesses and charities. Only the availability of an authoritative open address dataset will make data cleansing a standard practice.

Any loss of revenue from licensing of AddressBase and PAF arising from open release of those datasets should be more than offset by economic benefits to organisational users, including efficiencies and new uses that will generate an increase in taxable revenue. In particular we may expect to see a growth in

demand for software solutions for managing address data.

There is no shortage of arguments and evidence for the value of unlocking address data. Government has received many representations on this subject; please see the bibliography in this post https://www.owenboswarva.com/blog/post-addr1.htm.

The state of UK address data is a mature debate and at this point the onus must be on Government (and Ordnance Survey / Royal Mail) to demonstrate evidence of value from maintaining the current artificial scarcity in address data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The most effective initiative the Commission could undertake in this area is to support the funding of cloud infrastructure for the public dissemination of analysis-ready earth observation data products.

The Copernicus programme is an unparalleled open source of raw data. Many organisations in the UK public and private sectors have the technical skills to exploit this data and combine it with additional data from local and national sources to produce new outputs with specific applications.

However EO outputs are usually very large datasets and few organisations have the resources to store and distribute this data without charging users for egress costs. This limits the potential for frictionless sharing and public benefits.

I urge the Commission to examine the capacity problems in this areas, including potential for developing infrastructure that will support better availability of geospatial data for UK overseas territories and other countries where the UK provides support for sustainable development.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Ordnance Survey has made a good start with the Zoomstack trial. However I would like to see a more assertive position from Government on data standards for geospatial, and in particular a push to discourage use of the non-open Esri file database (GDB) format.

The Commission may also wish to develop a view on metadata standards for geospatial data. Is GEMINI still the right approach, or are there international standards that would increase interoperability in cataloguing of UK geospatial datasets?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No response. I found this question too general.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The Commission should make a clear distinction here between the public sector in general and the small but powerful number of soi-disant public bodies, including most of the “Geo 6”, run under special rules that encourage them to exploit public data for commercial income.

As the default model, public geospatial data assets should be developed and maintained from central government funds (or local authority funds if the need is specific to local areas) where there is a business case based on a public task. That public task may be at the organisational level, at the level of the sector in which the public body operates, or based on an identified national interest.

These data assets should also be made available as open data, in order to maximise re-use and value for money from public assets.

Trading funds and similar business models are unsuitable for maintenance of public data infrastructure as they create irresolvable conflicts between public task and commercial incentives, and lead to information economies built on monopoly interests.

This is particularly the case with Ordnance Survey. There is considerable frustration among many developers and data analysts, particularly in web-based startups and the voluntary sector, that the highest-quality datasets maintained by our national mapping agency are not readily available to the public. [Text redacted].

Much of the early enthusiasm for the Geospatial Commission was based on the expectation that government would finally address the OS licensing barriers and other blockages that undermine reuse of land data for planning and housing applications. Unfortunately many of the questions in this call for evidence read as if they are simply market research for OS's future commercial strategy.

On a separate note, as a prerequisite for the investment model I urge the Commission to develop a clear view on which geospatial data assets (existing or conceptual) have primacy as national spatial data infrastructure. Those assets should be monitored and protected by governance rules, similar to National Statistics status, with an expectation that the user community will be consulted on significant changes.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

I would like to see the Commission prioritise ground-based LiDAR, urban sensor webs (for air pollution, traffic management, etc.), and the potential of high-altitude pseudo-satellites (HAPs) for remote sensing.

The Commission should also emphasise the need for ubiquitous and affordable high-speed broadband (both fixed and mobile). Broadband may not be geospatial infrastructure as such but connectivity and throughput are essential to the effective sharing of geospatial data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Underpinning infrastructure for the UK's geospatial data assets should be publicly funded and maintained, with a minimum amount of dependency on private sector participation.

However the private sector should continue to have an important role in identifying user needs and implementing use cases that make use of this infrastructure, and in development of some intermediary services for delivering the benefits to the public.

Where public services are delivered by the private sector, as in transport and energy sectors, the Commission should promote stronger expectations that businesses will publish (either directly or through government) more geospatial data about their operations.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes. Working within the Public Sector Mapping Agreement (PSMA) framework presents numerous challenges to sharing and use of Ordnance Survey's detailed mapping data, and acts as a deterrent to publication of geospatial data (in particular by local government) that might otherwise be freely available as open data.

Open licensing is the most effective technical approach to improving the interoperability of geospatial data. This is axiomatic; open licences place minimum restrictions on the purposes for which individual datasets can be used, which reduces barriers to use of combined datasets.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

I hope there will be no need for the Commission to maintain this role beyond the short term. I would like to see PSMA/OSMA, the PAF PSL and similar arrangements wound down in favour of a funding model that makes geospatial data infrastructure freely available at the point of use in all sectors, not merely the public sector.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Environment Agency, BGS and equivalent agencies in other parts of the UK should have access to detailed data on the location and costs of insurance claims arising from flooding, subsidence, vandalism and other geographic and property-related risks, to assist with economic modelling to support public investment in management of those risks. Some of this data may need to be shared on a commercially confidential basis, but aggregated outputs from this modelling should be published as open data.

As a further example I would also like to see DfE publish catchment area data for schools derived from anonymised pupil location data extracted from the National Pupil Database. This would help analysts understand interactions between school catchments and behaviour in the housing market, among other applications.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No response.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Government should make greater use of the Single Data List to collect and compile national data layers from geospatial datasets held at local level. https://www.gov.uk/government/publications/single-data-list

Government should also mandate use of schemas for returns of geospatial and other data from council sources, to ensure consistency and interoperability.

Replacing PSMA with open licensing of MasterMap data would also make it easier for local authorities to publish and share detailed mapping, for purposes such as planning, housing, road maintenance, and flood management.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No response.

Q18: Are there any other areas that we should look at as a priority?

The Commission should look at interactions between publication of geospatial data by public authorities and personal data risks. There are a number of unresolved issues that have not been tested in the courts or examined conclusively by the ICO. For example publication of address-level sale price data by Land Registry, and the recent withdrawal of PARSOL guidance on planning appeals data.

There are also potential data protection issues arising from the increased granularity of spatial imagery, as well as emerging technologies like drones and ground-based sensors used to capture environmental observations.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Connected cars and use of telematics in motor insurance, including as a basis for tailored pricing, will require infrastructure and a regulatory framework that protects privacy and reduces the extent to which individual behaviours will be shaped by insurers.

Rollout of autonomous vehicles, for the consumer market in particular, will rely on the availability of more detailed mapping of the built environment at ground level as well as infrastructure for managing data collected on-the-fly by vehicles.

There is also likely to be a need for more detailed mapping above ground level in urban areas to support the use of small drones including connected drones operating in swarms or flocks. These applications will require better building modelling but also data on weather and wind effects in built-up areas.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK should maintain involvement in regional and international initiatives related to geospatial data. Where participation has been compromised by EU exit there will inevitably be a loss of influence, but the UK should attempt to introduce domestic initiatives that dovetail with international standards.

For example the UK should continue to support the INSPIRE programme for exchange of compatible public data on environmental themes.

The UK has one of the most complex and sophisticated transport systems in the world. More open data and mapping in this sector could enable the UK to act as a showcase for technology and consultancy services that could be exported to other countries.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No response.

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The "geospatial data types" require to be expanded to include:

- Real time aerial photographic digital mapping
- GNSS data sets
- Real time remote sensing data capture – all satellite datasets + radar + Shuttle data + specialist satellites – mineral investigations, oil seeps, etc
- Real time Lidar data
- Environmental monitoring real time satellite data – weather, geotechnical events, vegetation, etc

Nothing should be excluded

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Skills in topographic survey, geodesy, computer technology- systems, platforms, databases, etc ; micro-electronics, education at all levels, legal responsibilities about “spatial data” land and hydrographic data collection

Geographical information systems in schools

Support organisations providing new data sets – eg remote sensing –DigitalGlobe, NRSC, SPOT, etc

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Needs
Better promotion of geomatics, geological, remote sensing and geospatial skills
Further developments in schools and universities for courses
Better remuneration packages

Gaps
Geodetic appreciation of topographic and hydrographic data

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Private datasets : geophysical and bathymetric datasets of oil & gas basins held in archive by data centres –Norway, Ireland, UK , Hungary Spain etc
Public datasets: The Republic of Ireland has large hydrographic data sets that are difficult to access. These have value in confirming oil and gas datasets.
Faster communication systems are required.
Legal and commercial hurdles require to be addressed.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Faster wireless communication systems are required, faster platforms and bespoke databases.
Real knowledge can be gathered by having a multitude of data sets in the one computer environment.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

There needs to be a collaborative approach with all the main data providers: Digitalglobe, SPOT, European and British providers of datasets to a centralised database.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There needs to be a major research workshop with all interested parties to define the best opportunities:

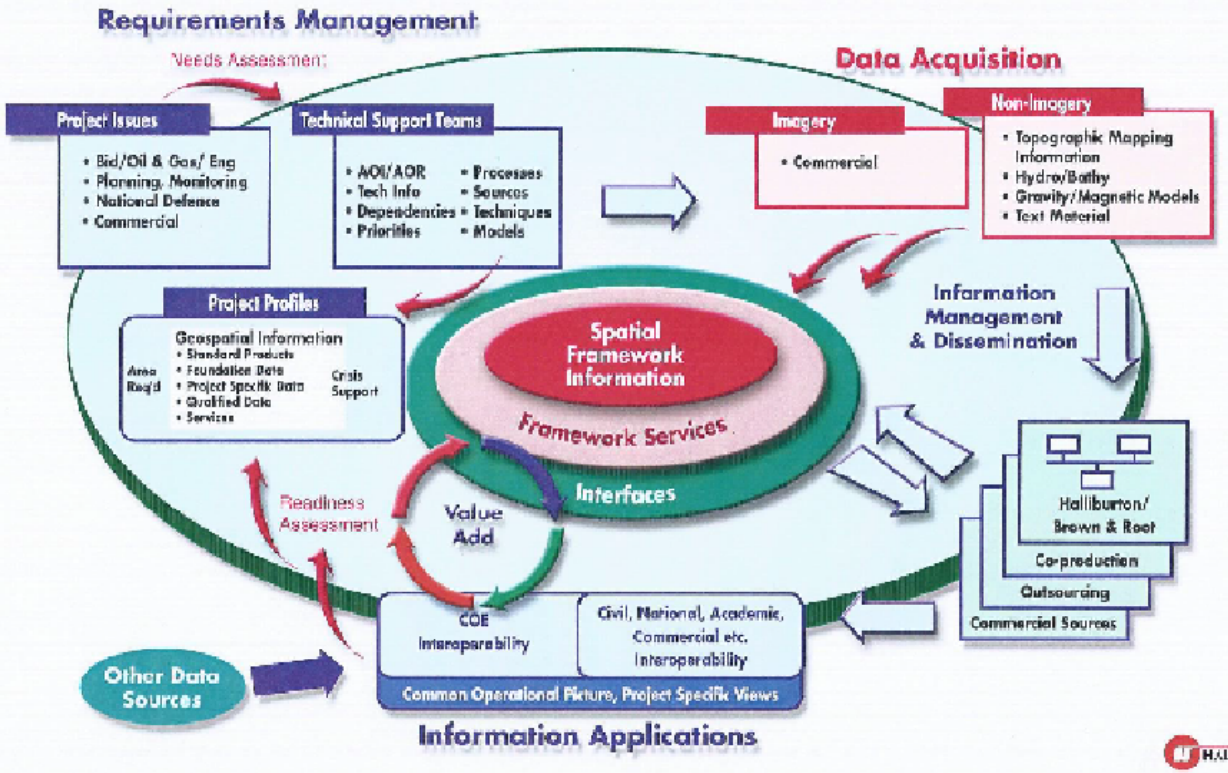
Eg Traffic management – air, sea, railways, roads

Timing mechanisms

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

See below

Geomatics Process Cycle



Source :NIMA

4575-5

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

To have a method of recovering costs of data enhancement from other users of the “added value” datasets.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Join international monitoring GNSS organisations
Generate support aid to countries requiring national digital mapping
Support international mapping organisations
Provide university courses in geomatics, GIS and computer platforms

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

The private geospatial sector has been decimated in the past thirty years. The next generation requires our support to provide the requisite data at a rewarding cost for its efforts.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There are challenges on how the original OS maps were constructed that can lead to inconsistencies.

Is raw GNSS data capture of data points more consistent?

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Becoming a centre of excellence

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Shuttle topographic elevation data for unknown mapped areas

Lidar data for better ground topography –digital ground models.

National archive centres- remote sensing and topographic mapping

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Regular meetings between the interested parties in England, Wales, Scotland and Northern Ireland to determine a coherent way forward.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Better education and awareness from the national survey authorities in partnership with the best practice operators.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

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- **mobility**
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- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

GNSS use in engineering and construction for roads, railways and pipelines

Transport management on motorways

Geological and geotechnical investigations/ monitoring of faults, landslips etc

Q18: Are there any other areas that we should look at as a priority?

Generation of databases that can co-exist along side each other trending to a coherent system of data.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Road and railways planning and construction
New Housing
Planning requirements for councils
Defence usage

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Join international survey and mapping orhanisations – FIG
Equivalent worldwide hydrographic organisations –IMCA, etc

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

NIMA (USA), IGN (France), Mapping Science Committee (USA), German, Russian (Roskartographia) and Chinese equivalents, Australian, South African and New Zealand equivalents.
Review texts such as :The Future of Spatial Data and Society, Summary of a Workshop produced by National Reseach Council , 1997 ISBN 0-309-05735-3

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[Text redacted]	[Text redacted]

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

I refer to the work recently done in Denmark by the Ministry of Taxation and the Danish cadastral organisation to use geospatial data for the purposes of land revalorisation.
I attach a presentation which illustrates how municipal taxation has been overhauled to apply valuation based on geographic non-variables such as plot size, plot location, plot level variance and proximity to amenities (positive such as lakes or negative such as a council rubbish incinerator).

This work enables Denmark to demonstrate compliance with land taxation best practice as defined by the United Nations Economic Commission for Europe:

- Services clearly defined social objectives
- Raises significant revenue
- Exclusive government control
- Administered in a way that the public sees as fair
- Simple and cheap to collect
- Difficult to avoid making payments
- Shares the tax burden equitably
- across the community
- Encourages good use of resources

Property valuation in Denmark .pdf

Q17: Are there any other areas that we should look at as a priority?

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Informed Solutions
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

It is our opinion that there is a requirement for further collaboration and cross-sharing of skills between domains, of which geospatial skills are one, but data science and computer science should be others. The convergence of these areas will produce innovation – GIScience can progress through coupling with the latest developments in data analytics and technology in general. For example, the areas of artificial intelligence and real time processing are currently at the centre of innovation, and there are a multitude of applications in the GI space.
Similarly it is our opinion that there is a need to introduce awareness of applied geospatial skills in domains that are not always technical by nature – including health, environmental services, utilities and planning. Looking at spatial data through the lenses of a specific domain can unlock new insights that may not necessarily be found by someone with purely geospatial expertise.
In practice, it would therefore be beneficial for the commission to best focus on collaborating with other sectors, in order to introduce GIScience skills into the training and education of professionals in these areas. Similarly, GIScientists should ideally receive a considerable amount of training in programming and general data science in order to further their capability and potential for collaboration with other domains.
We recognise that there is a need across the whole digital and technology industry to close the digital skills gap, and that geospatial skills could also be an aspect of this. Therefore, looking to engage across disciplines rather than silo-ing geospatial skills to geographic training is the way to combat this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

It is our opinion that there is a lot of 'untapped' potential in location-enabled smartphones and personal devices in terms of providing locational intelligence. The location-aware capabilities of smartphones are improving rapidly, and their ubiquity can be a great tool to encourage public participation in spatial. Whilst it can be appealing to invest in expensive positioning technologies with high specifications, many common devices are now creating data of a sufficient quality for most purposes. Many other fields are taking advantage of the potential of (automated) data collection from personal devices, and so there are a multitude of ways in which further economic growth can be achieved from the geospatial data already collected. However, with the scale of this data comes the need to invest in technologies to develop the potential for big data and real time processing.
In a similar vein, there would be a lot of value in focusing on the convergence of data coming from the full spectrum of positioning and spatially-enabled technologies – earth observation satellites, high end GPS, smartphones, UAVs, Internet of Things. In particular, gaining rapid access to spatial information to assess a situation, for instance, during natural disasters, could benefit from data pulled from as many sources as possible. Of course, this would need further research into data interoperability between these sources, and perhaps the development of a framework that outlines best practices. Also, this extends the point made in our response to question 2, where we mention how collaboration across sectors is required, to achieve the benefits of the current technology trends in AI and real time processing of data.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector can be considered as large customers of the UK's geospatial data assets, having plenty of experience in using these assets, and therefore have an idea of what works well and what doesn't. They should be able to provide input when decisions are made by the providers of the UK's geospatial data assets on the standards and underpinning infrastructure, e.g. when new version of datasets are released, or assets are migrated to other hosting platforms.
Equally – the potential for the private sector to utilise the UK's geospatial data assets would be increased if their 'user needs' were considered whilst developing the specification of the data standards and ensuring interoperability. Only by considering the requirements of all users (private and public sectors) can we develop data products and platforms that will be beneficial in the long run, and generate opportunities to innovation in the future.
As a D7 country, the UK has a role in pioneering the development of the digital economy, which must include the development of the UK geospatial data assets.

In this spirit of openness and adoption of open standards, we can learn from the work done by the government digital service (GDS) which has paved the way for new interoperable platforms, services, and design practices. All this has been done in collaboration with the private sector, supplying and designing digital services to government – therefore, it cannot be questioned that the private sector have a role to play in continuing this leadership in the digital space.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Jacobs
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Include some reference to points, lines, polygons, raster and vector data. These are the common data types in GIS.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Geospatial/GIS training could become part of GCSE geography?
- Ensure that government bodies and regulated industries utilise GIS and go digital in their workflows.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- Jacobs has a large geospatial team and significant GIS capabilities embedded in parts of other teams. GIS training needs to be cascaded more wider in the other teams.
- GIS could be better covered in undergraduate & postgraduate courses in Civil Engineering/Geology.
- School careers services and STEM activity could promote geospatial careers.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Historical ground investigation (GI) data from government bodies (e.g. Network Rail) & regulated industries (e.g. water, energy).
- This would reduce uncertainty in ground conditions and associated construction delays and overspend.
- Less time would be required digising archive pdf format data.
- Potential for lower spend on future GI work.
- Act of parliament required mandating sharing of GI data with BGS.
- Utility plans often are hard copy or pdf. This causes issues with digitising the locations which is laborious and has potential for inaccuracy with hazardous consequences.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- Post codes may need to be supplemented with Easting and Northing to allow better locational accuracy.
- Data based on postcodes not accurate enough for engineering use e.g. historical petrol tank locations (point data) in Landmark Envirocheck data based on post codes but may be on a large site so not enough accuracy to locate for remediation work.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Commission could fund research or trials of new technology to make UK a world leader in geospatial.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Improved public wifi and 5G network.
- Drones and remote sensing.
- 3D printing
- Automation

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Deliveries by drones using Easting & Northings.
- Traffic diversions due to accidents on interactive road signs or via public wifi, similar to live sat nav from Google maps.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Training teams to manage/collate geospatial data where none exist and expanding current resources where they do.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- Improved public wifi/broadband/5G+ internet connections.
- Improved GPS accuracy, more satellites?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- Public utility companies could be regulated to provide their geospatial data to the public as Open Data.
- Telecoms companies own & maintain the infrastructure currently. These are public goods that may be better in public hands.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- There are isues with ESRI software and certain WMS datasets being in WGS84 grid vs British National Grid.
- Issues with interoperability between Bentley Microstation, Autodesk C3D, & ESRI ArcMap.
- The loss of EA's "what's in my backyard" website has made it harder for those who are not proficient in ArcMap to view the EA's WMS data.
- Utility plans often are hard copy or pdf. This causes issues with digitising the locations which is laborious and has potential for inaccuracy with hazardous consequences. It would be better if these were available digitally direct from the statutory undertakers as Open Data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Demand that public bodies and regulated industries provide their data digitally as Open Data.
- Set standards for data & data exchange.
- Impose penalties for non compliance.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- BGS 1:10,000 scale maps are a paid for product that have greater detail than 1:50,000 scale (Open Data). The 1:10,000 scale maps could be added to the BGS geoindex and WMS services.
- Access to statutory undertakers utility plans. These are costly to retrieve and the format is not user friendly. Knowing utility locations and clashes would be a benefit in planning future development.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Set the best standards that the regions will want to adapt.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Increasing resources of local authority geospatial teams. Imposing geospatial standards on them.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Add 1:10,000 scale geology maps to BGS geoindex and WMS services.
- Health & Safety excutive data should have spatial data captured e.g. where are F10 sites, where are accidents happening, where are fatalities. The data could then be interrogated to improve safety.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Drones.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By promoting our expertise and selling it to the world.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

From a geotechnical perspective the UK appears to be ahead of the rest of the world in this field. Particularly the BGS, many developed countries e.g. Germany have no equivalent of the geoindex.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Joint Nature Conservation Committee
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Defra sponsored non-executive NDPB

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

About JNCC

JNCC is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation. We make extensive use of geospatial data, to provide evidence based advice on biodiversity and natural capital across the UK, in the Overseas Territories and areas beyond national jurisdiction; examples include species observations, habitat extents, soils and geology, vessel monitoring scheme, earth observation and data on pressures from human activities. JNCC published its Open Data Policy this year and aspires to support and maximise re-use of its data.

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

"

1. Geospatial data: Information where place is a key feature of its source and/or purpose for which it is used.
2. Positional data: Groups of individual datasets that usually have location as a secondary purpose, and which describes activity or physical assets grounded in a particular place.
3. Geospatial identifiers: Data that provides the means of anchoring positional data to core geospatial data.
4. Geospatial services: Higher-level insights and products, often involving layers of various types of spatial information."

The above type definitions seem appropriate for both terrestrial and marine applications.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The availability of locaton based data is improving rapidly, along with sophisticated tools for manipulation and analysis, many of which are free and open source. Geospatial skills and concepts are needed to process, analyse and interpret the data and should be core part of geography, computer science and data science curricula. The skills needed overlap geography, computing, coding and earth observation.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

JNCC provides evidence products which draw on the increasing volumes of geospatial data available about the environment, including positional data such as vessel monitoring system data, positional data available from social media and the rich geospatial observational data available from Earth Observations. To extract value from these sources requires a combination of geospatial, earth observation and data science and computing skills. Our recruitment shows that there are still relatively few undergraduate or postgraduate training activities that concentrate on providing the combination of skills necessary to handle and extract value from the large volumes of different types of data available. Graduate geographer EO specialists have under-developed scripting and programming skills whereas graduate programmers lack sufficient experience working with location based data and data science skills. The Geospatial Commission can help advocate the need for more multi disciplinary training in higher education to provide the skills needed to exploit the new data sources.

ONS have hosted the 'Data Science Accelerator', backed by GDS and the Government Office for Science. The Geospatial Commission could lead in a similar capacity building 'Geospatial Accelerator' to help leverage benefits from large scale geospatial data.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Challenges to data access stem from both licensing and availability and the practicalities of handling and analysing very large volumes of data.

Soils data is currently very costly to access and only available under licence. It would provide a key resource for habitat mapping, habitat condition assessment, natural capital and ecosystem service analyses.

The public sector buys high resolution aerial photography for specific purposes but this is siloed within individual organisations. Common access to aerial photography would be an asset to multiple applications.

There is an explosion in drone use in public and private sector – co-ordinating the archiving and sharing of public sector drone coverage would reduce duplication and maximise re-use / value.

Access to environmental data collected by marine industries (e.g. grab samples, seabed videos) and where not commercially sensitive, acoustic datasets (bathymetry, backscatter, and sidescan primarily). This would be of value because of the sparse nature of marine offshore data, and would fill in gaps with high quality information that can be incorporated into composite products with multiple uses for marine planning, management, monitoring and assessment.

Vessel Monitoring System data can aid estimates of the impact of fishing activity, the major human impact on the marine environment. Access is controlled as it is commercially sensitive but access to aggregated/anonymised data is problematic and data quality is affected by the lack of computing resources available to process it.

Earth observation data (both commercial and open) is increasingly available but barriers to use persist from the data volume and complexity. Specialist knowledge and large-scale computing capacity are required to calibrate and process the raw data into an analysis ready form. Co-ordinated provision of standards based EO data and products would be a significant enabler for public sector and commercial exploitation.

Land parcel boundaries are important data inputs to automated land classification and habitat mapping but examples such as the Rural Land Registry (RPA) are problematic as they are themselves derived from OSMM and habitat classifications derived from the RLR have seen limited distribution.

For data products (as opposed to raw data sets) versioning, update cycle and archiving of previous versions should be a consideration.

There is a requirement for public sector capacity for storage and public distribution of large datasets generated by smaller orgainsations who cannot host the data longterm themselves due to storage and egress costs. The Commission could play a role in providing economies of scale through central hosting and procurement.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address based geospatial identifiers only have terrestrial relevance and limited value outside populated areas. Terrestrially biodiversity data is captured using British National Grid. Beyond the shoreline latitude/longitude with a defined co-ordinate reference system provides consistent terrestrial and marine coverage.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

JNCC has played an important role aiding Defra, Scottish Government, Welsh Government and Northern Ireland assembly in identifying where the recent improvements in Earth Observation Data available under open licenses, most notably Sentinel data from the Copernicus Programme, can help deliver environmental policy. JNCC has provided technical and work programme management to the Defra Earth Observation Centre of Excellence and has contributed to the Scottish Government Remote Sensing Group, Wales strategic evidence EO sub group and supported workshops within NIA.

A key lesson learnt from this work is that many applications share common initial EO processing steps. Where a standard can be agreed for these steps, and data to the common standard shared, there is a dramatic improvement in the productivity of resources used to analyse the data. JNCC has worked with the UK Space Applications Catapult, the National Centre for Earth Observations and others to develop UK Analysis Ready Data standards that align with the global standards work in this area.

Whilst there are benefits to JNCC and other public sector environmental bodies in sharing data sets created to the standards, there will be benefits in some other areas of government, and beyond government to SMEs providing analytical services and to voluntary sector bodies also wishing to use EO data to achieve their charitable objectives.

The Geospatial Commission can help achieve wider participation both in the development and revision of standards, and in creating sustainable mechanisms for generating UK standard data sets and providing access to them, building on the start made through the Defra Earth Observation Centre of Excellence and working with UK Space Agency, NCEO, Space Applications Catapult and AGI.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

As technologies and tools evolve, promotion of open standards for data formats and online services are fundamental to maximising uptake and utilisation of spatial data. The Geospatial Commission should engage with open standards organisations (e.g. OGC) to ensure data and services can be used within both open source and proprietary tools.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No specific response.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The technical expertise and domain knowledge to maintain our geospatial dataset reside in the specialist organisations that originated them. The role of the Commission should be to secure that expertise and provide the impetus and infrastructure to make the data as openly available as possible.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No specific response.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The role of the private sector in development and maintenance of inftrastructure is welcome as long as it is predicated on the provision of open standards based data formats and services.

Key data assets should be produced for the public good (OS mapping, soils, geology, habitat mapping, crop mapping, flood risk, aerial imagery, LiDAR, EO ARD). These should be made openly available to enable private sector to innovate in producing new value added products and services.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Some public sector datasets have significant value beyond the originating organisation but the originators lack financial or technical resources to effectively manage access (taking into account the work to remove personal information or commercially sensitive detail). VMS data is an example of 'big data' that requires significant processing at scale but due to the large data volumes is currently reliant on subsampling to make the data processing manageable. The remedy is to provide technical/financial resources to unlock their value to others.

JNCC are a member of the PSMA and its successor giving enhanced access to OSMM. Challenges remain in creating usable datasets from it e.g. generating a continous coastline layer for defining coastal extents of protected areas is very time consuming. A library of routinely updated, widely applicable standard products would be highly valuable if they could be used freely without the restrictions of 'derived data'.

JNCC is heavily dependent on partnership agreements and citizen science groups for collection of much our terrestrial data. These bodies don't have easy access to detailed mapping (including land use and ownership) for access and data capture. More open access to this data would improve the quality of collected data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The commercial Earth Observation sector is providing an increasing range of observing products, varying from very high resolution, low frequency, high cost but very information rich observations, to daily coverage with lower resolutions and less information collected. JNCC has experience in combining both commercial and open EO data to provide effective environmental evidence and sees an increasing role for commercial data, if its purchasing can be streamlined and the costs and licensing negotiated so that it is within reach of operational public sector budgets. At present the UK Space Agency, through its Space for Smarter Government Programme, is working with public bodies to develop understanding and test use cases for applying commercial EO data sources, but it does not have the remit or function to create the cost effective purchasing mechanisms and licensing, such as exists for aerial photography. Modern collective purchasing agreements also need to look at where they can reduce costs in using the data, through the provision of OGC services, and placing the data sets where they can be used analytically together. The Geospatial commission can help by either creating frameworks for dispersed purchasing of new data sources such as EO or by pulling together the requirements and business cases for collective purchasing.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Assessing the UK's marine natural capital assets would benefit from open access to the highest quality bathymetric products, and open access to data collected from seabed samples by BGS.

Monitoring and assessing habitat condition would be improved with easy, timely and free access to comprehensive data from Vessel Monitoring Systems (VMS) including increasing the volume of data processed by making additional processing power available.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The Geospatial Commission should provide clarity over is role and relations with the four countries. Its partner organisatons have a variable footprint with limited coverage in Scotland and particularly Northern Ireland where only UKHO have a remit.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No specific response.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No specific response.

Q18: Are there any other areas that we should look at as a priority?

No specific response.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No specific response.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

No specific response.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The Copernicus Programme have a free and open data access policy for earth observations data to encourage maximum use by small companies and public sector alike.

EMODnet (European Marine Observation and Data Network) www.emodnet.eu - a network of organisations working together to collect, process and make freely available data from the marine environment, as interoperable data layers and data products. Themes covered: Bathymetry, Geology, Seabed Habitats, Chemistry, Biology, Physics and Human Activities. The target audiences are public sector, civil society, private sector and the research community.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Knight Frank LLP
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Definitions 2. and 3. in the call for evidence are sound.

Definition 1. as written may inadvertently limit understanding of the ubiquity of geospatial data.

For example, within the HR database for a large employer, the geographic identifier may not generally be understood as being a **key feature** of either the source or purpose of the database. Nonetheless, within our consultancy practice, the use of client HR databases in GIS has proven invaluable in quantifying how changes to that organisation's property portfolio can impact staff commuting time, enabling better decision making.

Accordingly our recommendation is that the word "key" is dropped, and "or could be used" is appended:

- Any information where place is a feature of its source and/or the purpose for which it is used or could be used.

Definition 4. as written might suggest that only higher level analyses, based only on discrete data inventories, constitute services driving understanding and value from geospatial data.

For example, in our consultancy practice higher-level geospatial output would be a macroeconomic summary like "what homeowners intend to do in the next 5 years, by local authority area", whereas a conceptually basic GIS finding would be "3 of 10 of this developer's candidate sites are bisected by high voltage cables." The

former might be a press piece and the latter might be specific advice to a client, but the latter is clearly crucial information when applied in context.

This highlights the subjectivity of the term “high-level” when defining geospatial services; we would recommend this is not used.

In addition, a definition based around the concept of layers implies the benefit is mainly derived from analysis of discrete data inventories, when information synthesis and further statistical assessment through GIS are equally powerful facets of the technology.

Accordingly we would suggest the explicit reference to layers is dropped.

A possible alternative could be:

- Insights and products, usually articulating spatial characteristics or relationships

Both suggestions above are aimed at promoting the broadest possible recognition of the potential to harness geospatial data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Three priority skills areas that could be examined to bolster UK geospatial capability are:

1) Programming/Scripting
2) Data Management
3) Professional Impact

Programming & Scripting

The former would help address the skills gap in the technology sector already recognised by coding lessons being provided in schools.

(Related to Q3, how can careers in the sector be best promoted?)
A possibility would be for the Geospatial Commission to look to encourage collaboration between GIS modules taught in Geography and any coding curriculum. Examples include SQL and Python. Whilst programming/scripting is not necessary for a successful career in GIS it does provide more flexibility and opens up career opportunities, particularly as a developer. The job security, flexibility and greater salary offered by having programming skills should encourage careers in the sector.

Data management

GIS skills can sometimes become associated with specific software platforms, whereas the prerequisite bulk data management skills may encompass a number of systems, both spatial and non-spatial. The ability to handle and manipulate large volumes of data should be seen as fundamental to delivering value from geospatial data use.

This skill would be taken for granted across other technical specialisms, such as data warehousing. The disparity could be for a number of reasons e.g. time required to train a user on the GIS element alone, a focus on short-term GIS projects, or *task* as opposed to *outcome* focused work.

A data management skills focus also supports interoperability with BIM development and would facilitate better flow of geospatial data. It should not be the case, for example, that the first time geospatial practitioners and architects try to make sense of each other's digital worlds is out in industry; asset-sharing and joint problem solving needs to be taking place between courses and faculties within universities.

The crossover with BIM improves salary expectations which should make the Geospatial Industry more attractive. Crossover with BIM and related industries will improve job security. Whilst there are plenty of free, online courses these skills gaps could be formally addressed through courses at "Centres of Excellence" proposed by the Geospatial Commission. In addition, industry wide standards for GIS specific / general data management could be created as per BIM PAS 1192 http://bim-level2.org/en/standards/. If these standards are seen as attractive to clients in a similar manner to professional accreditations (e.g. CGeog) then data management practices will be raised across the industry.

Professional Impact

Geospatial practitioners struggle to exert a coherent collective identity, and we have observed this manifesting itself in third party organisations as geospatial capability being overlooked, misunderstood, poorly tasked, wrongly considered as an IT issue, or judged solely on its revenue generating merits.

We have observed procurement decisions made by parts of the public sector that displace and marginalise in-house geospatial capability. We have observed cases where, on our recommendation, public sector organisations have sought to increase their capability but funding is denied, only for greater sums to be spent on consultants offering similar or reduced capability. We have seen representatives from public bodies publicly endorse third party products but privately concede they know such procurement involves overcoming significant interoperability challenges that have been flagged by their in-house geospatial practitioners.

These are confidence issues that must be addressed; confidence from the individual practitioners themselves, and confidence within the organisations as a whole to

deploy skilled people and technology where they can be best utilised.

For individuals, collaboration and collective problem-solving skills must be more of a focus during university. Students of geospatial science must be linked up with courses that address in-depth the pressing needs of society, and they should be encouraged to see past the initial and more superficial stages of analysis and data reconciliation to take ownership of the subject matter.

Too many candidates that we have interviewed have jumped from one GIS role to another, bouncing between industries demonstrating knowledge and experience of the systems and methods, but little commitment to (or passion for) the subject matter. If they fail to fully understand and engage with the subject matter of the organisation their capability supports, they will have limited success in owning and disseminating actionable insight from that capability.

The reach of the Royal Geographical Society's Chartered Geographer programme should be expanded, as it represents a mechanism by which geographers out in industry remain connected and engaged with peers, and potentially, trained. The Commission should take a position on whether some of the skills gaps identified are translated to accreditation requirements.

Similarly, the Royal Institution of Chartered Surveyors has the accreditation competency "property records and information systems". [Text redacted]

Both accreditations should be adapted to encourage more intra-disciplinary skill transfer, for example by setting minimum number of hours CDP across major heading such as technical skill, communications, formal training etc.

Any broader changes to the curriculum needed to address the above deficiencies should clearly be differentiated by level, but there should be a gradual and continuous increase in the understanding of geography and geographic data using everyday examples like smartphones and apps.

Even at higher levels of education, a greater awareness of the value of geospatial data exploration and insight in non-GIS courses is highly recommended; this would promote a better common understanding of the value of geographic data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Skills and careers for industry more broadly are covered in question 2.

Geospatial needs gaps at Knight Frank mainly relate to public sector data use.

[Text redacted]

In addition to policy layers, we also require planning applications data, including the digital red-line extent and any associated massing data (such as a BIM model or its 3D shell) submitted to a local authority. See question 4 for commentary on public sector data availability.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Geospatial data is key national infrastructure, but has not been clearly identified as such across government.

The National Infrastructure Assessment covers the importance of a fully digital economy but does not mention National Spatial Data Infrastructure; for which obligations were transposed into UK law in 2009 through the EU INSPIRE Directive. References to BIM, GIS and geospatial data are also absent in any explicit form.

The National Planning Policy Framework draws no attention to geospatial data as an asset of the public sector in opportunity appraisal, the creation and standardisation of evidence, or plan-making.

Physical Infrastructure Data

One example of how these incongruities manifest themselves is the proposed Oxford-Cambridge Expressway, key physical infrastructure for which £27 million has already been committed. In our most recent request to Highways England for geospatial route options data, we were instead referred to a .pdf which a team member was then required to georeference and digitise.

In the property industry we need to rapidly make sense of new infrastructure proposals and their likely effect on client portfolios, the housing market and the wider socio-economic landscape yet we are interpreting, re-creating and indexing spatial data originating from the public sector.

Knight Frank has the resource to recreate this data but others do not. While the Berks, Bucks & Oxon Wildlife Trust brought environmental concerns about the

Expressway to light in a BBC report in May of this year, their website shows that as of September they are still waiting for detailed GIS data from Highways England to fully assess the impact.

In this instance, the cumulative effect of the obfuscation and lack of timely cross-examination has been characterised as a "democratic malaise", with a particularly serious charge against "megalomaniacs who draw lines on maps" appearing in the Guardian in August.

As an example it shows how GIS data is at once central to, and yet absent from, discussion on sustainable growth and the changing socio-economic landscape.

Part of the Commission's role should be to fully realise the concept of the "Digital Twin" as set out in the National Infrastructure Assessment and mould it around data defining function, form and location. In this case the definition must be sufficiently specific so as to include detailed, accurate and attributed GIS data, released to estate agents and wildlife trusts alike, at the point at which route options are announced.

It is also important that, post-Brexit, the Commission considers in what form the INSPIRE directive will be retained in domestic law.

Policy & Future Land Use Allocations

The Commission's Partner Bodies comprise a spread of organisations focused on physical and cadastral topography; a "what is" view of the UK. One of its early challenges will be to build stronger links with organisations with plan-making powers to flesh out the "what next" view.

There are troves of spatial data on future land allocations spread across the public sector which are urgently needed by industry.

In a portfolio review Knight Frank conducted for [Text redacted], we profiled all industrial land in London and cross-referenced this with London Plan allocations on Strategic Industrial Land (SIL) so [Text redacted] knew which sites could be considered for use in perpetuity. However the Greater London Authority (GLA) could not provide us with a GIS file defining the outlines of London's protected industrial sites, stating the data was a borough resource and was only available through the individual local authorities. None of the authorities in question provided readily available GIS data, and again Knight Frank were again left to examine .pdf documents of varying scales and standards. The quality of advice that Knight Frank was able to offer [Text redacted] was affected by the lack of availability of this strategic geospatial data.

In this case the lack of centralisation of SIL data was particularly surprising given the GLA's role in ensuring SIL consistency with cross-boundary OAPFs (London Plan Policy E5 B3. 3). The procedure for SIL release also heavily involves the GLA,

whose oversight is required in ensuring a London-wide balance between housing and industrial land use (London Plan Policy E5 D.). SIL is essentially a GLA policy mechanism disavowed as a borough data asset.

The GLA included a map of SIL across Greater London in the London Plan, but it was the output of a graphic designer. We would strongly recommend that plan-making bodies are made responsible for the collation and centralisation of strategic land allocation data. [Text redacted].

There are clear precedents for doing this, for example the Town Centres hierarchy in fulfilment of EU Commission / Eurostat Urban Audit requirements. The resulting single London-wide town centres layer has existed in a consolidated form as part of the London Datastore from at least 2008.

Again, like the INSPIRE directive, the implication is that the public sector is willing and capable of compiling and publishing strategic geospatial data where there is an explicit legal duty to do so. While this suggests some changes might only be achieved through legislation, these changes would be low cost and high gain.

Planning policy allocations are deliberated on through a diligent and fastidious process at great expense to the public sector. However, the culmination of these efforts - the adoption of a local plan - is not accompanied by a corresponding release of spatial data guiding the efforts of land agents and developers in realising the vision articulated by the local authority. This is a missed economic opportunity and should be a matter of considerable focus for the Commission.

Changes to Existing Dissemination Mechanisms

The above examples illustrate cases where organisational and operational changes are needed before access mechanisms need to be considered. However there are a significant number of public sector organisations that have already made great strides towards opening up geospatial data.

Two examples of note are the Coal Authority and the London Borough of Tower Hamlets. Both have substantial spatial data resources and have built web systems where the data can be accessed as a WMS.

The Coal Authority, however, has introduced a scale threshold on its WMS feed, meaning the data feed cuts out below 1:25,000. This is assumed to be to protect the organisation against the use or interpretation of data at larger scales, when it was never intended to be so accurate. However, the by-product of this is that it is not possible to send a spatial relationship query to this WMS feed. For a development portfolio of 1000 sites, we cannot tell a developer how many might be affected by historic coal-mining. In building complex site appraisal models that run as scripts and report on multiple criteria, we are forced to omit any layers that cannot be queried in GIS.

It raises the question of why the Coal Authority, in building such capability, has not passed on detailed caveats to industry about how the data was created, and why it is subject to interpretation or caveats beyond certain scales, instead of simply denying end-users the ability to query it.

It is certainly possible to manage such data responsibly. In dealing with [Text redacted] Council, we previously took local plan data themes as raw data, even though [Text redacted] Council advised us that the boundaries had only been created for use at 1:10,000. We were able to use them at larger scales but with appropriate checks and techniques to manage and caveat findings accordingly.

Similar to the Coal Authority, the London Borough of Tower Hamlets provides local plan policy data as a WMS feed, in what could certainly be seen as a standard for discussion with the Local Government Association. Consumers of this WMS feed can view the data at any scale, but again are denied download and query capability on this data.

These organisations have already taken considerable initiative in organising spatial data and systems that communicate opportunities and constraints to the property sector. They simply need better direction on how to embed scale and usage caveats into metadata so that information can be opened up in its more useable form.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

For Knight Frank, the ability to establish links from address data across other government point and polygon data is key, and we are largely able to achieve this using Ordnance Survey AddressBase.

Limitations of this database are exposed for apartment buildings, where multiple address points will appear on the same building centroid. These points are also not differentiated by floor.

This causes issues during [Text redacted] assessment, where a building might contain 20 addresses, 5 of which have been classified as commercial and the remainder residential. It is not possible to estimate the volume or percentage of commercial use within that building using the floorplate in OS MasterMap because a database user cannot tell if a commercial unit is ground floor only or is occupying multiple floors. If it was known that residential addressing began at floor 3 for example, then an accurate determination of the retail component could be made. Additionally, if all residential addresses contained a link to floor number, much better density figures and ceiling height estimates could be determined. A conceivable mechanism for gathering this information would be through the voter registration teams in individual local authorities.

Addressing using gazetteer products such as Ordnance Survey AddressBase suffers from the lack of general visibility of the UPRN unique identifier in the data. In attempting to propagate the use of the UPRN, Ordnance Survey licencing permits subscribers who have fallen out-of-licence to retain it against any proprietary address data, in theory allowing further cross-referencing.

However, to the general public or for organisations along a physical supply chain, the UPRN remains highly abstract and is not used. The postcode remains the go-to address identifier but in its current form cannot function as a UPRN.

In addition to better differentiated 3D addressing, future developments must include the convergence of the concept and use of the UPRN with the ubiquity of the postcode. The Irish system incorporates a postcode that is unique to the individual property, ostensibly to facilitate more reliable deliveries and routing, and should be evaluated technically.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The frequency of provision of earth observation data, and its granularity, has significant potential to drive benefit. Pixel recognition technology means that changes in land use could be detected much closer to real-time, for example monitoring where there is a cumulative risk to urban habitats, biodiversity, or surface water run-off from households paving over gardens.

Thermal insulation imaging has the potential for significant economic benefit in reduced fuel bills, but this also requires highly granular infrared imagery captured more regularly.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

New technologies that would support the property industry would include mechanisms for better provision of station-to-station travel data through TfL and other transport providers, movement sensors routinely monitoring and democratising footfall figures, and AI feature classification tools for both aerial and street level (i.e. Google StreetView) imagery.

Technology or methodologies accurately determining (or cross-referencing) building stock age would be hugely beneficial within property and planning.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

/

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

As touched on under Question 2, this is largely a function of the confidence and profile of individual geospatial practitioners, the technical understanding and leadership of those above them, and the level of integration of procurement practices across that organisation.

A significant risk to the relevance of the geospatial industry in the UK is the excruciatingly slow move to 3D across the public sector. As referenced, we have observed cases where public sector GIS teams were denied funding to embed 3D capability, only for greater sums to be spent on external consultants offering 3D in platforms that are not interoperable with GIS.

We know of one external consultant excluding potential customers' in-house GIS teams from discussions on systems and standardisation to end-run interoperability concerns. The end result is that the local authorities who procure this system:

- Cannot create and visualise their own massing models in a 3D environment
- Cannot cross-reference insight derived from these 3D models with the vast catalogues of spatial data held within that local authority
- Must continue to engage the external consultant in question to add new 3D massing and development proposal models into the visualisation system (this increasingly complete future skyline model is then used to sell the capability into other local authorities.)

The local authorities in question never own and can never democratise the component data. Despite furnishing the third party provider with detailed planning applications and proposals data, their only tangible return is a rolling year-on-year subscription to the software.

New procurement mechanisms for systems handling spatial data are urgently required across the public sector in order to protect years of investment in systems and skill that have delivered considerable gains for industry. This would also protect the ability of these authorities to work collaboratively with a range of stakeholders across industry.

This mechanism might include a mandatory evaluation question such as “Does the proposed external capability analyse or visualise geospatial data?”, in which case the affirmative would require the sign-off of the Head of IT to ensure obvious opportunities to bolster in-house capability are not missed.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The evidence base for larger mixed use development proposals will almost always include estimates of footfall and movement data, and indeed there are consultants who specialise in either modelling this data (spatial attraction models) or providing actual counts based on aggregated mobile phone data.

The problem here is that the modelled data can be subjective, while mobile phone data is incredibly expensive to deploy. There is a danger that this important aspect of urban planning is not evidenced in any universally queryable way.

Going forward, essential infrastructure must include footfall sensors routinely monitoring and democratising movement data. This could unlock benefits from urban grain permeability assessment to determining optimum planning use mix in revitalised high streets.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

We believe that the private sector should have a leading role in the development of the UK's geospatial capability. The private sector must be able to provide pertinent insight and expertise to Government on the use of geospatial data in addressing pressing questions of industry, removing uncertainty, and driving growth.

Rather than just initial input, this would be an ongoing consultation where the private sector is used to identify new datasets and enhancements and giving a sense of how the data will be utilised outside of the public realm.

Conceivably, additional private sector reporting responsibilities could drive the identification of new opportunities. For example, [Text redacted]

More broadly, it is the role of firms like Knight Frank to enable data-driven decisions and develop analytic insights, partnerships, and products for clients. These partnerships develop and endure over a number of years, and only through this long-term collaboration do we get the full sense of the client's operational and land requirements, which in turn informs our understanding of industry spatial data needs.

We do have a concern that there is an implicit focus on SMEs and start-up enterprises as the primary means of driving innovation and creating new opportunities from within the geospatial industry.

Unlike the National Infrastructure Assessment and National Planning Policy Framework examples in Question 2, the National Industrial Strategy White Paper singles out the potential of the UK's world class geospatial data.

It states the following government policies:

- "We are committed to making this data available to innovators"
- "We want the UK to be the best place to start and run a digital business."
- "We will explore means of identifying businesses with scale up potential"
- "We will […] open up freely OS MasterMap data to UK-based small businesses in particular"

There is an implicit conceptual link here between innovation and SMEs, and while clearly there are many examples supporting such a premise, Government cannot afford to miss the enormous economic potential of working with larger and more established businesses.

Engagement beyond the Call for Evidence and subsequent strategy must reflect the data needs of larger established players, where there is:

- Broad existing client base and potential reach, with a proven ability to match land acquisition and development opportunities with client financial and operational models

- Substantial existing investment in technology, infrastructure and analytical capability
- Specialists who interpret findings for specific geographic and thematic submarkets
- A greater willingness to be transparent about methodology and interoperability (assumed to be because it is taking similarly sized competitors longer to recreate comparable bespoke geospatial research)

By approaching each client problem differently, we spot similarities and differences between submarket data requirements that bolster our understanding of needs of industry more broadly.

Our recent industry accolades include the 2018 Innovation Award from the British Property Federation, where there were several start-ups in our category. We would ask that the Commission accordingly recognises the key role of larger established business in driving innovation and new value for industry using geospatial data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

See question 4.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission needs be very visibly seen to act for both geospatial capability as a technical and analytical disciple, and, as explained in a number of examples above, for the profession and its practitioners.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

A thorough understanding of business and employee numbers and composition within custom geographic areas is currently lacking within property, planning and development.

The ONS inter-departmental business register (IDBR) has enormous untapped potential in this regard, but is subject to stringent controls and is typically only used within local authorities. The rationale is that the data is disclosive, but that is to ignore the possibility that minimum thresholds could be set on the number of records used to compile a response via a WMS analysis server.

For example, we would like to be able to say "what is the % of the workforce employed in manufacturing within a 15 minute drive of Oxford". The result to this query would not be disclosive, if the ONS provided an analysis server that could accept the incoming 15 minute isochrone polygon and query it against raw data. The data could be checked before it leaves the ONS server to verify that it describes either a minimum number of businesses or a minimum number of employees.

Additionally, there is insufficient data available to us to advise developer clients on subsurface hazards, and part of the Commission's work could be to flesh out or co-ordinate minimum standards and access requirements for such information. We have been asked by clients for contextual geospatial data on electricity, gas and sewerage systems as well as unstable bedrock / sinkhole risks and areas potentially still at risk through historic mining.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Scotland and Northern Ireland have become "terra incognito" for developer site and opportunity finding using digital cadastral data in GIS. Both administrations should be encouraged to greatly accelerate efforts to devolve cadastral data, even with minimal attribution, to enable site searches to take place.

Knight Frank advises clients with large national portfolios, such as [Text redacted], but much of our insight is limited to England and Wales because we lack the ability to readily tie ownership extents to other data sources for Scotland and Northern Ireland.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The Commission is advised to snapshot local authority capability nationally through the Local Government Association.

This “census” should be addressed to Chief Executives, and should be seen as an opportunity to:

- Restate broadly that geospatial information should be seen as national infrastructure and that local authorities have a special responsibility for protecting and resourcing this asset accordingly
- Determine the number of people in that authority who are geospatial practitioners, GIS operators, gazetteer custodians or geographers (relative to the size of the local authority’s staff base and its area population)
- Capture current job titles, number of years experience, and levels of seniority
- Capture any impediments to the widespread deployment of the technology or the further upskilling of staff
- Aim to determine why there is such divergence in approach between individual local authorities e.g. local plans published to a variety of technical standards and scales
- Capture key successes for benchmarking

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

IDOX must be incentivised to pool and democratise geospatial data relating to planning applications for the c. 200 local authorities it provides planning portals for. This single joined up picture of planning applications, including those rejected and lapsed, and the exact spatial extents they relate to, have been described as “vital” information by a number of our developer clients.

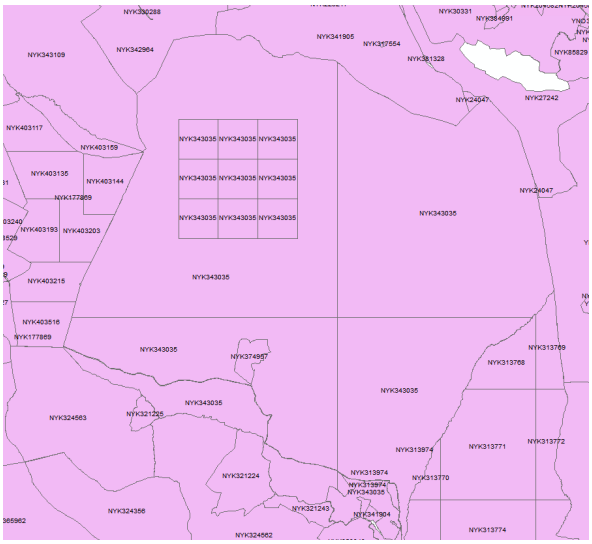
Q18: Are there any other areas that we should look at as a priority?

Ownership of data themes: a number of local authorities have dismissed data access requests on the sometimes opaque grounds of “data ownership” – usually on the basis that a data subcomponent, or some element of the base data, has come from another entity (even when any objective bystander would associate the synthesized or completed data solely with the body we have requested it from).

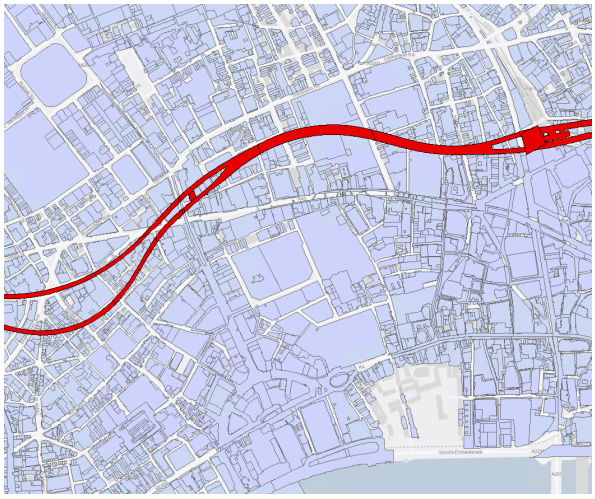
There needs to be clearer distinction between different tiers and hierarchies within public planning as to what data can and can’t be shared, given we have seen differing approaches across a number of authorities.

Another issue that needs to be addressed as a priority is the structure of the Land Registry National Polygon Dataset

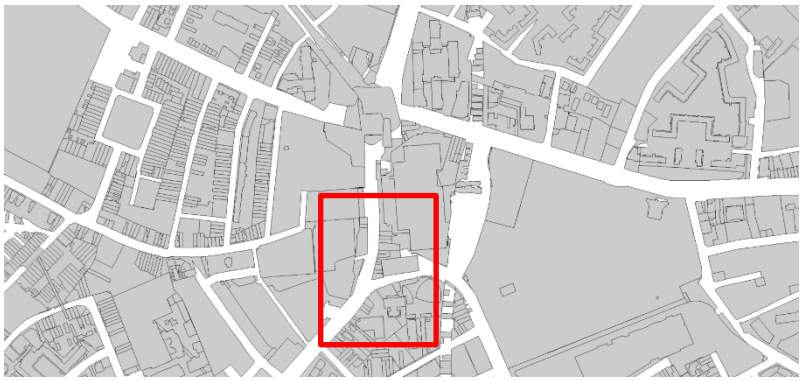
Large titles sometimes show as a grid. This is problematic when joining datasets and calculating area or extent of ownership:

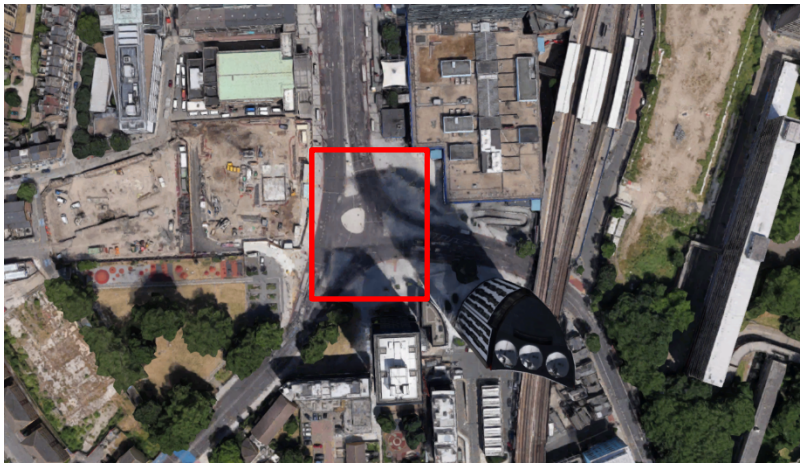


Subterranean parcels are visible but without an identifying attribute to suggest they are subterranean. It would be useful to have an attribute to identify these to filter titles:



Historic parcels have not been removed following redevelopment:





Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

/

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Co-ordination and engagement with bodies such as FIG (International Federation of Surveyors) and other international agencies with strong links to the UK geospatial community (MapAction, MSF etc.)

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Centralised 3D planning and massing models:

City of Boston

https://www.esri.com/about/newsroom/blog/3d-gis-boston-digital-twin/

City of Zurich

https://www.esri.com/library/casestudies/zurich-switzerland.pdf

Postcodes functioning as individual UPRNs:

Republic of Ireland

https://www.eircode.ie/benefits/overview

Thank you for your time in completing your response to our call for evidence.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Lancaster City Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

In my view the word "place" in the definition of geospatial data is a little too vague and should be replaced by "location".

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Promote understanding of the importance of data, data quality and data management.

Improving awareness of the importance of geospatial skills amongst those responsible for managing organisations that create, maintain and consume geospatial data.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Awareness amongst senior managers of the benefits of geospatial technologies to improving efficiency and service quality. Provide senior managers with info on case studies and best practice by all available means.

Facilitating GIS Apprenticeships (for newcomers to the profession of ALL ages!) would be very helpful and bring geospatial skill development into line with other skill streams.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Access to Land Registry title ownership data would be mutually beneficial in identifying and registering council-owned land holdings and also improving service delivery for cases of fly-tipping and graffiti removal etc.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

As an address creating authority and PSMA member our address data needs are currently well met, largely thanks to the PAF Public Sector Licence. I suspect private sector developers of new geospatial technologies may take a different view!

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No comment

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No comment

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No comment

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Ten years of cuts to council funding have greatly reduced the resources available for creating and maintaining address data. Given the importance of accurate address data to geospatial technologies, both current, emerging and as yet unknown in the future, this cannot continue. Ways must be found to fund this work adequately otherwise address data quality will decline to a point at which it is not fit for purpose. Options include enabling councils to receive revenue from those who sell address data and/or charging for the creation and distribution of new addresses by Street Naming and Numbering Officers. A consistent, nationwide approach is needed to this issue.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No comment

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a considerable role to play both as a provider of leading-edge infrastructure technology (satellites etc) and as a provider of technology and services to the Commission's Partner Bodies and other customers.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Use of the AddressBase Premium UPRN/USRN in ALL public sector geospatial datasets would greatly facilitate information sharing leading to improved efficiency, service delivery and reduced losses due to undercollection and fraud. Eg the UPRN in VOA data would greatly aid the identification of untaxed commercial premises.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Maintain the PSMA and PAF PSL.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Access to Land Registry title ownership data would be mutually beneficial in identifying and registering council-owned land holdings and also improving service delivery for cases of fly-tipping and graffiti removal etc.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

No comment

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Do everything possible to make senior managers and elected members aware of the benefits of geospatial technologies to their organisations and their customers. Facilitate and encourage investment in the resources required. Warn against the consequences of continued cuts to local authority funding in this area.

Maintain and promote the KHub. Regional events to promote/share best practice.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No comment

Q18: Are there any other areas that we should look at as a priority?

No comment

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Smart Cities/Districts, Autonomous Vehicles, drones etc. Many regulatory challenges around safety, responsibility for issues arising from poor data quality etc.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

No comment

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comment

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Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Land Quality Management
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Processing of earth observation data – there is an increasing wealth of data, but limited skills to process it effectively.

Automating use of GIS (so not just point and click) via use of command line.

Skills beyond GIS being just software commands notably understanding CRS

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Not answered

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Biggest issue is:
Large scale mapping – ie Mastermap. A good map is the starting point for any land based project. It enables us to understand what is there, and put all the data generated for the project in the best context – helping make better decisions.

In my field we also need largest scale geological data available (1:50K is useful, but 1:10K would be better). We can WMS 1:50K, but getting 1:10K is a visit to BGS for a paper map, which you probably aren't allowed to put in your GIS

Coal Authority data can currently be accessed via interactive map, but would be more useful as open data to go into GIS.

Aquifer data and Source Protection Zones are currently available via MAGIC, but need to be downloadable OGL

Price is a barrier and so are licence conditions.

Data needs to be able to flow freely through professionals, so we can build on each others work and not have to repeat part of it. At the moment, for every project we do, we see multiple professioinals working on maps, plotting proposed buildings, borehole locations, contamination results, archaeological features etc. And then printing the resuits in reports as pdfs. The next person in the chain then has to import the pdf, and georegister it (slow, inaccurate). They should just be able to import the required data layer.

Paying for the underlying mapping, means you have to sign a licence agreement and that often means you cannot get / provide the data from those before / after you in the chain.

The licence needs to be OGL

And if an acknowledgement is needed, this should automatically appear – ie be attached to the data in some way. Otherwise someone has to check what the acknowledgement is, add a text box etc.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Not answered

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

At the moment searching for useful EO data is so time consuming and often unrewarding. Yet we all know it has potential

First step is portal to quickly access EO data. High quality search and filter techniques. Quick method to screen out clouds. Choose wavelength. Clear indication of resolution. Ability to snip area for download eg shapefiles, drawline.

One option to develop capability is to provide tutorial on demonstrably useful datasets accessible from the portal

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Not answered

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Not answered

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Not answered

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

LoraWan eg Things network. This has capability to offer geolocation without GPS (based on triangulation with 3 things network gateways).

EG every council could put up one things network gateway in their county town as a starting point, from which other organisations and individuals could build.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Not answered

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Biggest problem is accessing data from data.gov.uk is time consuming and a bit of a lottery. For a start the search is not very sophisticated, so there can be too many datasets. Needs advanced search with AND OR NOT etc.

Much worse, is that SO MUCH data is unavailable so if you are searching on spec, you can spend a lot of time to no benefit. This should be able to be filtered out on the front page. I have particularly struggled accessing LIDAR and Digital elevation models. I believe they are there, but I cant easily find them – I often end up with a promising looking file being unavailable.

Also some datasets are done by local authority; this may be how the are collected, but you will struggle to find the local authority you want, due to the poor search facility. A filter by local authority is essential.

Sometimes you have to register – eg historic England. If that is really necessary – there should be one registration via data.gov.uk that gets transmitted to the other organisations

Multiple different licences eg EA Conditional Licence – it takes time to decide what you can/cant do – this needs to be simplified as much as possible to be useful. The result of complex licencing is that some will use it and ignore it/ others will take lots of time (ie productivity loss) trying to comply /others will not bother to use the data as compliance is too complex – especially if you need to be able to pass the data onto others eg for planning/development..

Spatial data catalogue is very useful
https://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue
But redesign to allow multiple downloads eg all flooding datasets, would save so much clicking

If the data was easier and less time consuming to sift through, it would be more likely to be included in a GIS and used to analyse the problem at hand.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Not answered

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Slightly concerned that this question implies that the public sector will have access to data, that will not be open.

Currently, when working for the public sector, if they have data, that they would like us to use to assist with the problem at hand, we often get stuck at the licencing issue described above; this delays things (productivity again).

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Where data clearly crosses boundaries, it makes sense to have a single UK approach – eg air quality, wind speed, water flows (all fluids). Many physical features would benefit from UK approach – topography, rivers. Where data is collected on an administration boundaries, this can be more flexible, allowing for creativity and learning from each other.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Not answered

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
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- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Brownfield redevelopment, geotechnical assessment, environmental assessment, archaeological assessment

Q18: Are there any other areas that we should look at as a priority?

Air Quality
Water Quality
Hazard Management

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Everything to do with assessing land – including redevelopment, energy, minerals, conservation.

Regulatory challenge is clarity and easy technological solution to what data you can/cant pass to others.

Transport – potential for revolutionising public transport by providing better information. Eg what bus could I get from near where I am. This can be done via google maps, but it is a frustrating experience.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Not sure about 'best', but some suggestions are:

Geospatial commission youtube channel show casing new datasets, and what has been done with them

Futurelearn (since that is our own Open University) MOOC on using open data

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Google maps – at the moment this is the go to place for mapping; many use the google api for mapping applications. As we have Mastermap which is much much better, we should aim for mastermap to be the go to data /app /api for UK mapping.

Thank you for your time in completing your response to our call for evidence.

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Landmark Information Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The referred geospatial data types appear accurate at a high level, however as with all data it is not only important to consider the type of data but where it is sourced and the intended use. Without considering the intended use it is almost impossible to deliver value. An additional concern is that when presenting descriptors at a high level there is a risk of ambiguity as to what category a dataset may fall into, more detailed descriptors or current examples may be useful in this case.

Based on some of the considerations above, a "metadata" data type could be included. This data type facilitates better understanding of a dataset, providing context on the collection method, maintenance, currency and its limitations. Enabling data users access to this information is crucial for delivering reliable and accurate products and services to every industry.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There are several areas that the Commission should target to improve capability within the UK, the first of these is visibility of the sector and perceived benefits outside of traditional use cases. The Commission should work with existing and emerging technology companies to highlight the benefits of employing geospatial professionals. This could be completed by marketing high profile case studies and how value was delivered through geospatial data and techniques.

Landmark host a GIS Day event annually which gains high engagement, the Commission could support days such as this to promote GIS nationally.

Another area of focus should be around education and accreditation. The Commission should establish or promote the provision of professional qualifications to maintain talent with the sector and in turn drive the sector forward. Promoting geospatial content within schools and universities and in particular courses such as Information or Data Science will provide talent to the sector from less traditional routes.

Alignment of practices and consistency across central and local government in respect to the data that is produced and made available to support innovation is important. However, capital investment in information systems may also be necessarily to ensure the necessary system capabilities exist.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The largest requirement is in relation to experience and domain knowledge. An appreciation of the increasing capabilities of GI technologies and base data domain knowledge is rare but both are crucial skills for enabling innovation.

Highlighting that this sector is not only for traditional geospatial careers but supports a wide variety of modern job roles will address existing views of the sector. It is important to work with public and private organisations to effectively market and distribute job opportunities.

The Commission should promote the sector early and improve access to GIS and geospatial skills in the early curriculum.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

When considering which geospatial datasets to prioritise the following factors should be reviewed: “reference” datasets, blockers to market, public cost of creation, benefits to real world users and existing services and commercial markets.

Key “reference” datasets should be targeted under a flexible and transparent licencing regime that is easy to understand. Reference datasets such as addresses, commercial ownership and ratings will unlock derived data and varied opportunities.

Research into blockers should be undertaken, but it is important to understand what is constraining innovation, i.e. whether it is a question of absolute cost, or whether the licensing regime is too complex, or whether the quality and consistency of the data is insufficient. The Commission should not always look to improve access by making data free, indeed in many cases it will make sense to continue to charge for the data (e.g. a cost recovery basis) to ensure quality is not impaired.

“Raw” data collected as part of a public or statutory duty should be made available at nil or minimal cost, an example of this is the flood maps generated by local authorities as part of the NPPF. This will in turn empower private organisations to innovate and deliver value to real world users.

The public and dataset users should be consulted to prioritise the roadmap for updates. The ability for the public to submit requests for datasets to be published and the additional ability for people to vote for specific request would provide highly insightful information. Alternatively consider value based on the number of downloads from data.gov.uk and prioritise accordingly, the results of which should be available to the public sector to drive innovation.

The final consideration for prioritisation should be around what existing services and markets already exist around datasets. If the private sector has created a solution that provides value to the market, the Commission should strive to unlock new value and opportunities as opposed to replicating what is available.

The Commission could improve the quality of datasets where content and availability varies between government organisations, e.g. content and availability of planning application data from local authorities, or consistent release of flood map data in the UK (EA, NRW release as open data, whereas SEPA do not). Standardising datasets would ensure equal benefits across the UK.

Further quality improvements could be made through training, investment in infrastructure, clear national policies on data collection and maintenance, consistent content, transparent metadata, feedback mechanisms.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

This data needs a flexible and transparent licence, the current model can act as a blocker to innovation and increases development costs due to the need to record transactions for royalty purposes. This applies to both the address and its associated coordinates.

Standardising the market for non-addressable features is important. A uniform approach to how to categorise non-addressable features will support land and property transactions and ensuring emerging technologies are developed in a long-lasting capacity.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Commission should support this capability in a number of ways: data collection, removing technology blockers, supporting access and supporting the diversification of collection methods.

The Commission should aim to give greater priority to the capture of high-resolution aerial imagery within the UK via policies which encourage Air Traffic Control to better accommodate these types of flight.

In the past earth observation data has been very expensive and not very accurate. The promotion of new technologies and improved data accuracies need to be promoted, also the high commercial barrier to entry could be reduced through subsidies or support. However, it is still imperative to highlight the data that is available and the restriction on use.

Access could be improved through the development of image/data repositories with easy freely available access to these image libraries, e.g. portals or API. The repositories should offer standard image processing, e.g. estimation of cloud cover so that users can select suitable images/data for their requirements, NDVI, True Colour, analytical image downloads. The Commission should support the private sector in delivering innovative and appropriate solutions to market.

The Commission should develop the collaboration of data collectors to improve overall coverage and increase update frequency.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Develop or make available higher resolution satellite imagery, more frequent high-resolution imagery ensures that it can be regularly relied upon and valuable services can be built upon it.

Supporting the roll out of 5G will provide reliable connections to utilise geospatial data anywhere. The opportunities to stream and utilise large datasets in the field will provide crucial benefit to the land and property sector.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications support the identification, visualisation and analysis of opportunities with the biggest potential value. However, it is imperative that the following should be in place to enable this:

- Data that is accessible with flexible and transparent licensing
- Data that is not held in proprietary formats and the format is easily accessible
- Information on what the data is, its limitations and where it came from is available in the metadata

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The public sector should consider the following when investing in geospatial data: consolidation, private sector involvement, historical value, charging and technology.

It is imperative to limit the repetition or over-collection of data and to consider the value the data delivers when collecting. A focus should be made to maximise utilisation and avoid duplication when creating data. The public sector (and end users) would benefit from the creation of common standards regarding data collection and attribution, this would reduce complexity of utilising national scale data.

The public sector should continue their focus on core duties and create a model for outsourcing tasks to the private sector. This would improve data feedback loops, improve innovation in the market and reduced competition between the public and private sector.

Digitisation of historic paper records where a demand or need exists represents an opportunity to deliver unique and highly valuable data to the market.

Where cost prevents the collection and improvement of data required within the public duties of the sector then funding from central government should be made available. Where costs are incurred outside their public duties these could be passed onto the data purchaser on a cost recovery basis, in certain situations it may be appropriate for government subsidies if the product costs are high.

Investment within emerging AI technologies for quality assurance and data capture offer opportunities to save significant costs and provide valuable reassurance for the quality of data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The support of existing infrastructure and technologies such as OS Net and national transformation (e.g. OSTN) should drive the way in accelerating the UK's position in this space.

The Commission should prioritise the creation and development for national standards across addressing, indoor and outdoor positioning. National standards will promote efficiency in the creation of market wide solution and support innovation in the sector.

It is important to consider appropriate data privacy oversight, to ensure emerging technologies and solutions are not blocked by uncertainty.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should provide the back-bone for development and delivery of the UK's geospatial assets. Commercial models to support the costs required to maintain, deliver and improve the highest quality geospatial assets are imperative to ensure the UK retains a leading position in delivering geospatial excellence.

Working with the private sector to increase accessibility of data drives innovation for delivery and provides increased value to market.

Landmark has added significant value to the geospatial market for over 20 years, there are numerous projects that highlight the value of the involvement of the private sector. Examples of these include:

- Landmark's delivery of the EPC, Magic and DEFRA portals. These contracts were awarded by government agencies for the provision of services and resource to support the public.
- Significant improvements to change detection techniques have been developed through partnerships. For example, the Landmark / OS Historical Mapping Joint Venture.
- Finally, Landmark's value-added reseller model has provided significant revenue to government agencies through the payment of royalties. e.g. OS, BGS and the EA.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Inconsistencies of working practices across departments present a challenge as this often results in different levels of detail being supplied by different authorities for the same dataset.

Inconsistent policies on the release of data, including that held by both central government and local authorities, cause difficulties in managing effective, reliable and up to date data.

The devolution of responsibility causes fragmentation of supply of datasets causing data to be sourced from multiple locations.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By procuring geospatial data on behalf of the public sector, the Commission can negotiate improved, more transparent and uniform terms.

The Commission should look to define standards and specifications for geospatial data, and this should include attribution, collection and maintenance, which would improve support to economies of scale. Standards could also include recording of what has been captured, created and purchased.

By acting on behalf of the public sector the Commission would be able to lead the sharing of geospatial knowledge across the sector, this would also support the rollout of market standards.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Datasets that would be useful to improve access to include:

- Access to key local authority geospatial datasets that relate to e-conveyancing and the Ministry of Housing, Communities and Local Government's policy paper 'Fixing our Broken Housing Market'
    - Planning Applications
    - Building Regulation
    - Planning Appeals
    - Local Development Frameworks & Plans
    - TPOs
- Access to underground assets, e.g. potable water and sewerage networks etc
- Access to national infrastructure datasets, e.g. Cross Rail 2, Thames Tideway
- Access to high resolution datasets which are prevented by licencing issues, e.g. postcode level broadband information
- Access to archaeological datasets held at a local and unitary authority level
- Access to historical aerial imagery held by local and unitary authorities
- Access to the National Street Gazetteer
- Petroleum tanks licensing
- Residential and commercial ratings information
- Access to environment datasets published by SEPA
- National and Local Flood models produced by the various environment agencies
- Rural Payments Agency datasets – e.g. Single Business Identifier and land parcel reference number etc

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Quality standards will support the alignment of individual strategies across the UK. There needs to be coordination for all parts of the UK, the public sector and the private sector.

We recommend that the Commission review similar agreements, for example:

- One Scotland Mapping Agreement
- Joint Emergency Services Group in Wales

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The creation of a regulated Geospatial code and standards would ensure uniform data and process between different local authorities. Adequate funding and commercial benefits for authorities who implement such standards would ensure that these are upheld.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

It is our opinion that the Commission should target the blockers to enabling innovation and the creation of geospatial applications by the private sector as opposed the delivery of such. For example, while Ownership data is licensable, local development plans are difficult to manage, varied and not readily available. Additionally, local authorities often hold valuable historical data within hardcopy and archived records. The Commission should evaluate how to unlock this value, through either public sector engagement or private sector contracts.

Q18: Are there any other areas that we should look at as a priority?

- Environmental
- Historical
- Navigation

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Landmark continue to add value to geospatial data, and we welcome the opportunity to work with the Geospatial Commission and Geo-6 on methods of delivery innovation to the industries. For example, delivering on the requirements for highlighting available land for development alongside improvements to the planning process are crucial innovations. These are currently limited by the lack of standardised data and alignment within local development planning.

Landmark has a history of delivering innovations built upon geospatial data. Promap, Envirocheck, RiskView Residential and SearchFlow are all leading innovations that expand the reach and use case of geospatial data within their respective markets. Not only this but Landmark have also directly assisted government in improving the accessibility of data, for example MAGIC & DEFRA portal.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

It is crucial to represent the best of the UK's geospatial presence with high profile case studies, these should highlight both technological innovations or projects that exhibit best practice.

The Commission should look to create centres of excellence within the UK industry that enable collaboration, innovation and investment within the geospatial industry.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Singapore have created a Geospatial Master Plan, this presents a baseline assessment of Geospatial of Policy, Data and Institutions, Capacity and Adoption and Platforms and Technology. Within this is also clearly presents the requirement to support both start-ups and established corporations to drive the innovation and opportunities.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Laser Surveys Limited (Centremaps)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**x**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I would only add that many of these forms may also have a temporal aspect but this doesn't detract from the spatial interactions defined.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

As a part of the land and building survey sector and a member of “The Survey Association”, it is troubling that courses in geomatics appear to be closing down. I believe Mike Skicko at Leica is also pressing this point. There are some issues even recognising this as a profession for example even down to CSCS cards for site access.

I think additional education of creating API services might also benefit many in the community who could release powerful tools as easily consumable functions.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

It seems many organisations have little time for their staff to focus on learning as they have to get the day job done. It’s often the case that we hear of companies who only managed to introduce new techniques be personnel taking the initiative and working out of hours on their own projects. I’m not sure that this isn’t just a cultural failing in certain industries.

We supported a colleague through an MSc recently but it is a significant commitment on their part and it would be good to see more private sector orientated one-two day courses. I do see a number of companies running public sector orientated versions.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Land Registry currently require 20k annually to take their national polygons dataset (admittedly they allow free access for development) and offer no margin on things like deeds information. This works in particular for conveyancing software where there is significant value in the software and in tying users in. For developing bespoke applications it is more challenging and has certainly led us to developing other solutions first where we think we could have done more had a transactional model been in place and ideally allowing some margin to cover the costs of introducing beneficial customer functionality.

Planning information and in particular designated areas from the likes of local plans should be much more simply accessible as there is considerable waste in competiting organisations scraping this information.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Given that the UK addressing system is so well established, it is sad to see the need for the likes of WhatThreeWords for location. The latter allows no understanding of relative location in the way that postcode area, sectors and districts does.
Some sort of linking of addressing to highly accurate locations will presumably also be needed for autonomous delivery or even vehicle parking.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

A key concern would be that any joint investment through the EU is not lost due to restrictions in data access through Brexit.
We are beginning to see products appear relating to subsidence monitoring and flooding extents which show promise for meaningful solution accessible by users and industry.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I'm personally excited by the work of Gaist. Their capture of road condition (from vehicle mounted cameras) looks to be a fantastic means to reduce wasted public funds which are often patching problems inefficiently leaving less money for actually improving the situation. It is one of the few technologies I have seen recently which I truly believe could fundamentally improve outcomes for all.

I appreciate this might not be considered earth observation data but it is significant national level capture of big data with benefits recognised through machine learning.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

I have some concerns that removing costs to end users for large scale information such as that of Ordnance Survey could ultimately devalue it's worth and lead to the funding and upkeep of it's quality becoming a politically influences decision. One of the true signs that it retains it's value to so many is that people are still willing to pay for the data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

I think it is crucial that the private sectors value should not be overlooked, particular where work is already being done which can benefit all. Particularly, it is concerning where government department begin attempting to serve requirements for which private companies have an established market.

Disappointingly, some of those organisations who are seen as making their information freely available such as Google do not actually enable use of the data except through their own systems.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Our main concern is simply that there is consistency in how data is delivered to accelerate visibility and consumption. It is also important that the data is updated and that it is clear that this happening to the user who may not know whether a dataset has not been updated due to it being unsupported vs it simply being midway to the next delivery cycle.

There can also be some confusion where datasets have significant overlap. A potential issue is forthcoming with the planning open data OS is required to offer relating to property polygons. There will be confusion for users in understanding the difference between these (not legally based), the Land Registy and the versions held within Local Authorities. A lack in clarity of the purpose of such data will inevitably lead to questions concerning the reliability of the source agency.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

I think some caution may be needed in this area to ensure the use of a single private source leading to that provider being seen as de facto in the industry as a result. OS for example is just releasing speed data for it's OS Highways. Whilst I recognise and intend to utilise the benefits, I do have some concern that the commercial partner will as a result become market dominant. It might be better to highlight private entities who have been shown to offer a viable dataset in combination with the public data. This would drive others to ensure their data was equally as compliant.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Whilst Open MasterMap appears to have been identified as a requirement to open greater property/land development it is generally the higher level consideration of both restricted and supported zones of development which are considered in identifying areas in which to try and realise opportunities.The physical geometry of a site often comes much later and at lower cost in the development chain.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Understanding user's position absolutely in things like addressing for autonomous delivery and vehicles and also in marketing will require close consideration of impacting user privacy.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

From my experience the OS and BGS have respect internationally although seemingly even qualified civil engineers in Great Britain are unaware of the availability of the BGS services and data to the extent that non geologists create 3D geological models for projects.

If the open data and solutions around that can be made viable as internationally applied formats then many countries will appreciate the benefits of having a template to adopt.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

I am always impressed by the Swiss mapping agency and look at their implementations as offering inspiration.

I'm also surprised how good Norwegian building data is in capturing roof structures. Admittedly there are less buildings to maintain but there are clear benefits for instance in understanding solar energy options or liability to snow loading.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Leeds City Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
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Other - please state	

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The view appears to be a tiered approach but descriptions are abstract in definition. Could practical examples for each geospatial datatype be provided to aid understanding? We feel that would help make the explanations much clearer.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Introduce concepts of geospatial data at earlier stages in schools, make GIS applications more widely available to schools and ensure that schools have the resources available to be able to teach the subject.

In addition to this could the GC provide/devise a training programme which ties into the current apprenticeship levy within local authorities? Could include the following key areas:

- Basic, transferable skills: data provenance and trustworthiness, data quality (complete, consistent, accurate, etc.); basic database theory (RDBMS, SQL); web services and standards (WMS, etc.).

- Basic geospatial skills: geocoding, spatial analysis, map presentation. Focus on data and process rather than the software.

Another key aspect is having skilled resources in areas of geospatial databases/data warehouses management. A lot of attention is paid to 'what can we do with our data' but the 'how do we acquire/manage our data in the first place' often seems to be the poor relation in terms of organisational focus.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Leeds City Council doesnt necessarily have a skills gaps but more resource gaps, in both data management/governance issues and in 'front-line' GIS users. This was covered extensively in a recently commissioned SOCITM report.

One area unexplored/unexploited is what can be done with widely available online mapping tools such as Google maps and how it could enhance the internal GIS ecosystem.

Careers in GIS – start teaching geospatial subject matter earlier and with higher profile in schools, signpost to interesting/exciting/critical examples of geospatial implementations to inspire/motivate.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

This answer is made up of multiple suggestions from different areas

- A catalog of regional aerial photography would be useful. LCC holds some aerial data but there is a huge gap spanning a number of years. Having a more complete dataset could be used for educational purposes, planning enforcement cases, monitoring green space and so forth.
- 3D Models are available but vary in their detail, accuracy and coverage. These models could be used for a variety of uses from attracting inward investment from abroad to helping make informed decisions on planning applications. A standard needs to be agreed so models could be built by sharing information from various suppliers.
- Thermal mapping would be useful to target heat poverty, identify illegal dwellings, identify ageing housing stock and degradation of home insulation etc
- Air pollution/air quality data could be used to regulate pollutant emmissions by delineating effects of dust, harmful air pollutants and tackle hot spots.
- Companies such as Experian collect and create substantial amounts of data which would help with profiling, for example identifying areas of financial exclusion and so forth. A free-to-use profiling and segmentation data would be very useful.
- OS Open data and the PSMA has transformed access to spatial data for the better. However, it is time consuming to download and process this data. Time could be saved if the data was delivered differently, for example as a base map web service, or a simplified ready to use address service.
- Land Registry – there are barriers to many processes, particularly in land use planning sector in local government. Land ownership details are valuable knowledge for use in all sorts of situations e.g. promoting housing growth by assisting developers/owners on difficult sites – the whole process is much easier if ownership details are readily available. The best case scenario would be for all title information (ownership info and extent) to be made free and straightforward to access. Full titles documents are not necessarily needed so some scope for Land Reg. to continue to exploit the value of those. A good starting point would be free access to the LR Title Deed polygons, preferably as a web service, such as WFS.
- BGS – again, lots of data is made freely available but only at poor resolution, the best data is licensed and use is restricted – restrictive to many areas of LA work – Contaminated Land, GeoEnvironmental engineering, Ecology, Environment
- Coal Authority – As per BGS

- Google – more work needs to be done to see how far Google resources can be exploited.
- ONS – hold significant geospatial data, could the commission join forces?
- There should be a freely available national address database that is definitive and free to all. Addresses need to include height / floor level data for flood risk management purposes & for the emergency services response teams

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

It is essential that the key aspects of NAG (UPRN, address, postcode, coordinates, classification) are enabled as open data to promote consistent use of addressing, allow better spatial links to individual addresses and compete with PAF. Making the postcode open will be dependent on agreement from Royal Mail.

Whilst AddressBase is a good product it could be improved by having a one to many relationship between an address and different Organisation names (one limited company with a number of brands, or the growing trend for virtual offices where a company uses an address without having a physical presence in that building). Also a one to many relationship with PAF as one property can often be shown on PAF with two different addresses and postcodes (through terraces with two 'front' doors).

Good progress has been made with the use of the UPRN however the Valuation Office need to be forced to use the UPRN and link data to NAG to improve consistency and joined up working.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Open data is now embedded in public and private sector organisations. At present the government provides a data sharing platform via data.gov.uk. There are also other platforms such as our own local resource Data Mill North. These contain many and varied datasets. A platform specifically for open geospatial data could be created to host or signpost a range of information. For instance it might notify users when changes to national OS data and aerial photography are made, or aid the discovery of local data. If organised efficiently and updated regularly it could become a central point for obtaining data routinely required.

The advent of web-based mapping platforms has been transformative in the way that we present spatial information and provide location intelligence across a wider range of council services. One of the most interesting applications has been presenting spatially-enabled statistical dashboards allowing data and relevant statistics to be presented and interrogated/filtered by spatial extents. This ties in with other dashboard style applications such as Power BI, and we think that the point at which traditional text/numeral based BI tools meet spatial BI is going to be an interesting one. We should be looking closely at this.

3D mapping is another new technology for Leeds City Council. How best to develop a 3D model for Leeds and what use it can be put to is been investigated currently. We are focusing on town planning, asset management, regeneration, and investment – but could this could be expanded to other areas, for example heritage, conservation, neighbourhood management, etc. A high-resolution LIDAR (or similar) dataset of the UK, that is freely available to public bodies, would be of great use to develop 3D models.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The council already supports multiple small and monolithic systems. Many do not incorporate geospatial technology but could potentially be adapted to do so to great effect. Areas for consideration could be:

- Democracy and participation.
- Emergency planning.
- Service planning.
- Public consultations, citizen involvement.
- Event management, building management.
- Vehicle tracking – we believe some councils do this already.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Having core principals within the authority which lend themselves to supporting and promoting the entire organisation's spatial needs.

Dedicated funding assigned to a medium term vision is the ideal. An initial capital injection to enhance services and establish good practice. Once adopted this forms part of the business overall operating model.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Too many local government datasets still don't include the UPRN. It's inclusion would enable the spatial properties within the data and allow for better integration. Many local authorties are restricted by legacy systems that they don't have the funds to update. Legacy systems do not have appropriate fields or capabilities to automate integration with the LLPG. Making funding available to update such software for this purpose would be beneficial.

Projections/transformations can also be an issue, particularly when working with web-based systems. While tools are available to convert from one co-ordinate reference system to another, internal knowledge around this area is limited.

Downloading, processing and maintaining OS base map and address data from OS Open data and PSMA is time consuming and resource hungry. Publicly-available web services for base mapping, and for simplified addressing, would allow geospatial skills to be used more productively elsewhere. OS Zoom stack might be a good solution for easy access to base mapping.

Open data standards for 3D mapping would enable 3D models to be created more easily, and allow models to be used more collaboratively. For example, an open standards-based model for Leeds could be created by the authority, added to by developers, and viewed by stakeholders.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

A few of the cuff suggesstions :

- Centralised purchasing
- Recommend 3rd party suppliers
- Discounted purchasing
- Provide GIS services from a central point
- Facilitate collaboration

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Valuation Office holds data for commercial premises on floor space (area in square meters) and sells the data commercially as part of the full extract of Business Rates records. The data is really useful for numerous purposes (planning monitoring, assessing flood alleviation schemes, estimating employment data) but is only available as a one off extract, is quite expensive, and does not include change only updates so new full extracts are required everytime. Making this data available within the public sector (similar to PSMA terms) would be really useful.

Making aerial photo data available via the APGB contract makes sense, and it is hugely beneficial that local authorities have access to the most current imagery available. This should continue and would also promote the flying of frequent updates from suppliers.

Segmentation data created by companies such as CACI, Call Credit and Experian would help the Local Authority understand its client base and better meet their needs. Inhouse profiling is curently used but the analysis could be improved with more intelligent data from these external sources.

As mentioned previously, 3D mapping is rapidly developing as a key application and the provision of hi-res DTM/LIDAR data to give full authority wide coverage would aid in this considerably. Having this data freely available will allow the authority to develop and maintain it's own 3D city model at relatively low cost and with a high degree of flexibility, rather than have to follow more expensive alternative routes that involve buying a 3D model externally as a maintained service and the restrictions on IPR etc that go along with that.

Free access to Land Registry records for the public sector. For example LR Title Deed polygon data to help ascertain ownership of flood risk related assets (under section 21 of the 'The Flood and Water Management Act 2010'), and access to the Land Registry's 'e-services' portal to create mailing lists. There can be

hundreds of land owners involved when organising a stretch of river bank maintenance (removal of invasive species / litter picking / flood alleviation schemes) – currently it is an onerous task to identify individual owners to request permission.

As legislated (Flood & Water Management Act 2010, section 21), LCC are required to keep a flood risk asset register of all relevant assets and make this available (i.e. publish on the web, using web mapping). This register includes lots of drainage assets, watercourses, etc. LIDAR data is currently available via the government portal but this tends to follow the main river corridors – fuller coverage would be more useful.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Leeds City Council has begun to explore wider working possibilities within the region. This has included connecting with Bradford, Wakefield, York, Harrogate, Selby and others and discussing potential for collaboration. The following areas have been tabled:

- Joint technology licensing
- Knowledge and skills sharing
- Project inception and support
- Cost savings & efficiencies

It is early days and there is a lot of enthusiasm to explore how this may best develop. There is a lot of potential in this area which need not be limited to the Yorkshire region alone. Ways forward are still being explored but so far Leeds has committed to lead on a regional forum of interested parties. Leeds can easily provide an online platform for the hosting of related information. As usual resource factors are the limiting factor.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As a public sector body, our focus is less on commercial opportunities afforded by geospatial applications, and more on the positive impact they have on the intelligent use and information and data in better decision-making, which ultimately improves service delivery, reduces costs and generates efficiency savings.

The primary ways these benefits can be achieved are:

- improved sharing of data and services in a place-based approach where multiple services/partners collaborate in the spatial analysis of data;
- more intelligent use of location-based data e.g. customer insights and engagement, route optimisation and asset and estate management;
- facilitating the access and use of open data with the ultimate aim to improve better customer services and to promote a self-service approach by citizen and business.

Q17: Are there any other areas that we should look at as a priority?

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The most comprehensive datasets on the geography of Britain are held by its public mapping service, the Ordnance Survey (OS). In the USA they do not have the same stringent rules that govern mapping data in the UK. In the USA mapping data is made available more freely to commerce. This mapping data has many uses ranging from recreation to scientific analysis to emergency response. Please look at the National Map, The United States Geological Survey (USGS) for more information.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	LSBUD (Linesearch BeforeUdig)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We agree with your view.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

This is not an area we are qualified to comment on.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We partnered with PelicanCorp, an Australian firm in 2012/13 as they were supplying similar services (in our niche area of the industry) to several international regions. We assessed what was available across the World and partnered with the firm to be able to learn from international best practice.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We read with interest the 'Data for the Public Good' document as this premise is the foundation for the service that we have run since 2003. In that time, we have helped millions (in excess of 2.5 million searches per annum) of users access the data they need from our 70+ utility Members to help ensure works can take place safely and efficiently. This has helped improve their productivity, supporting economic growth and improving the delivery of public services. Providing that facility whilst satisfying the potential security concerns of our Members (who are responsible for critical national infrastructure) is a foundation to the success of the service.

The assets are often buried in the ground, and in certain cases date back to the Victorian period and earlier. Accordingly, the data can be limited and is varied across organisations. All the previous failed attempts to share this for the public good failed to align the desires of those using the data to the restrictions of those that own that data in the format that it exists in.

We understand the limitations of the UK's buried asset data. We also acknowledge the need to improve it on an on-going basis, and the inherent complexity of doing so. The key area for improvement with this data, however, is behavioural; making the best of the data as it stands and ensuring its accessibility. It is essential data that people rely on to stay safe thousands of times every day, so sharing the 'best available data' as well as possible is every bit as important as improving the data – and an area that is and can be improved now.

The asset owners that have worked collaboratively have found that by joining LSBUD, they have been able to share their data with more third parties than ever before, which provides significant benefits from a reduction in strike damages perspective as well as reduced costs and heightened industry awareness. This has come from creating a model where the user can access data free of charge whilst enabling the utility companies to share such information in a much more cost-effective manner than they could otherwise. It is a business model that benefits everyone involved and is therefore truly collaborative. Not having to charge users and therefore not putting a potential cost barrier to safety has been critical to its success in reducing damages; the key objective. Other countries have pushed a 'user pays' model that generates significant income but leads to a higher risk of significant costs elsewhere as users do not use the service every time they need to, which results in a higher risk of damages.

In terms of data, it has been achieved and developed without having to spend millions and spend years in the quest to have a common data format before any benefits are enjoyed. It is based on maximising the opportunities for interoperability for multiple stakeholders simply and effectively.

To build on this, improvements to data quality would allow better use of the data through further coordination and consistency, such as technological advances and innovation. This should be driven by the industry through a balanced representation of those that own the data and those that require it- something that has always been a challenge to achieve in industry groups that are predominantly made up of those organisations that require the data. The Geospatial Commission should, in our opinion, help facilitate that industry discussion and build on what has been successfully achieved so far.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

This is not an area we are qualified to comment on.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

This is not an area we are qualified to comment on.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Our feeling is that the most important challenge to solve is the improvement of data. Take care of that and the technology should take care of itself through private enterprise and competition.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

This is not an area we are qualified to comment on.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Our experience suggests that the public sector organisations (particularly local authorities) have been least interested in investing in their data to share it for the common good.

We would recommend that local authorities are supported to realise the data improvement benefits that private sector organisations have enjoyed.

Perhaps being encouraged to understand and follow best practice in how to manage their underground assets and evaluate how this could help those working in their areas on a day to day basis to increase productivity, drive economic growth and improve the delivery of public services (in particular utilities).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

This is not an area we are qualified to comment on.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

For the last 15 years, we have provided a critical public service as a private organisation for the benefit of UK PLC. We believe as a private sector enterprise, we are well placed to understand the requirements of the market, are flexible enough to adapt to change and remain conscious of the responsibility of what we do.

We have been proud to help enhance the use of GB's utility infrastructure and geospatial information, used by private and public sector in relatively equal measure.

In providing 2.5 million searches every year, we know who wants buried asset data and how and when to communicate with them. Business flow lines are already established and safety critical work is well protected. We have established the infrastructure that underpins safe ground working in the UK and this mature and effective process will only be enhanced by the introduction of more and better underground asset data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Our experience suggests that the public sector organisations (particularly local authorities) have been least interested in investing in their data to share it for the common good.

We would recommend that local authorities are better supported to realise the benefits that private sector organisations have enjoyed. Perhaps being encouraged to understand and follow best practice in how to manage their underground assets and evaluate how this could help those working in their areas on a day to day basis.

The data produced from the Utility Strike Avoidance Group's annual survey has consistently shown that the highest volume of strikes was on street lighting cables for every year from 2013 to 2016 which is linked to the lack of available data of their location.

Providing assistance to local authorities to accurately capture and digitise new assets (in accordance with PAS256) and existing assets would help reduce the risk of strikes and associated implications of human injury and other costly factors such as repairs and delays etc.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Our belief is that the Geospatial Commission's role is to provide an organisational view of the benefits available of using geospatial data most effectively. This should entail providing a high-level voice and opportunity to share best practice across the key public sector organisations.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As stated above, our service is available to all and is already well used by a wide range of private and public sector organisations. The assets registered are, however, predominantly private sector assets and adding key public sector asset data, such as local authority cables, pipes, culverts and any other relevant underground (or overhead) assets to the service would benefit all stakeholders to increase productivity, drive economic growth and improve the delivery of public services (in particular those utilities that we help protect).

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

We operate across Great Britain and receive significant search volumes across all areas. This co-ordinated, cross boundary approach means that more people use our service, even in areas such as Scotland, where the Scottish Government's Roadworks Commissioner established a service that was meant to do what we do.

Through a bespoke and adaptable approach (rather than enforced and prescribed), our Members and Users use the service because it provides them both with tangible benefits and is therefore a concept that we would recommend for UK strategy. The industry needs to avoid Government driven projects that do not deliver what the industry needs; we suggest that the Geospatial Commission's strategy is best placed to truly understand industry and support successful initiatives rather than develop replacements that may be driven by a particular stakeholder's requirements.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

As stated above, our service is available to all and is already well used by a wide range of large and small private and public sector organisations. The assets registered are, however, predominantly private sector assets and adding key public sector asset data, such as local authority cables, pipes, culverts and any other relevant underground (or overhead) assets to the service would benefit all stakeholders to increase productivity, drive economic growth and improve the delivery of public services (in particular the utilities that the service helps protect).

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As detailed above, the LSBUD service already provides significant value to those undertaking works. The key benefit and value creator is the avoidance of damage from utility strikes although at present there is not enough data to accurately measure the impact across all sectors.

The most measurable impact is the time saved by our users. In 2018, we will process over 2.5 million searches. For every search, each of our 72 Members is checked instantly. If LSBUD did not exist, the user would need to contact each Member individually which would take an average of 5 minutes per interaction. Accordingly, a single search would take 360 minutes or 6 hours which means that we provide a service that saves the UK 15 million man hours per annum. Furthermore, every new Member that joins the service provides approximately a saving of circa 200,000 man hours per annum.

It clearly shows the benefits for UK PLC, without any tax payer funding or support, whilst also saving the asset owners' time and cost.

The three categories that are particularly relevant are:

1. Property and land

Our service is used by landowners, residential occupiers and the legal profession for anything from erecting a new fence to completing legal deeds.

2. Infrastructure and construction

Our service registers pipeline and utility route information and is used daily to support its maintenance as well as the optimal route locations for new infrastructure to reduce planning times and maximise return on investment.

3. Mobility

The service is used to plan and inform roadworks, minimising disruption and reducing the impact of roadworks on the road users, therefore improving the area's productivity.

Q18: Are there any other areas that we should look at as a priority?

This is not an area we are qualified to comment on.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

This is not an area we are qualified to comment on.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

As stated above, we partnered with PelicanCorp, an Australian firm, in 2012/13 as they were supplying similar services (in our niche area of the industry) to several international regions. We assessed what was available across the World and partnered with the firm to be able to learn from international best practice.

We are developing our service on the back of this technology and can share how we have used it to the best possible outcome. We are the biggest single operator of such a service which means that we have more data than any other operator across the World. This means that we can develop opportunities such as predictive analytics quicker and more effectively than anywhere else in the World and lead the research as a result.

The Geospatial Commission could help by working with the regulators, including OFGEM, OFWAT, OFCOM, HSE and USAG, to support and encourage that better data is collected when damage incidents happen so that we all have better understanding of the causes why things have happened.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In accordance with the answer provided to Q20, with better damages data, we are able to benchmark our performance internationally, as part of a collective approach that has already started with organisations in the US, Canada, Australia and New Zealand. All the countries have elements of exemplary practice, whether it be cross sector industry compliance, membership or damage reporting. We would be happy to share our knowledge of international practices, following presence at international damage prevention conferences across the World, notably in the US and Australia where we discussed systems and models as well as regulator input and legislation.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Lloyds Banking Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**x**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There are a lot of datasets which include information on the natural environment which should also be included. These include but are not limited to
Wind speed
Rainfall amounts
River locations
Soil moisture defecit
SYNOP's
Location of historic landslides and other go-hazards

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The creation of a standard file format for all geo-spatial data would be a welcome addition. This file format should be capable of being opened on freely available software (e.g. R or QGIS). In addition all data should be made freely available for use under a commercial licence. Although the government has taken steps in this direction by the introduction of the open government licence However, many datasets are still not available in an easy to use format.

e.g. The BGS location of historic landslides.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Keeping up with what is and what is not available is a challenge. The creation of a database which only shows datasets that are currently available would be a welcome addition. Data.gov.uk often contains data sets which are not openly available.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The source data contained within the BGS Geo-index. These are often presented as layers which can be downloaded for ARCGIS or Map info which are both proprietory pieces of software.Being able to accurately locate the position of landslides and the nearest postcode unit is of interest to us from an underwriting perspective.

A large number of datasets which are held by the Met Office require you to pay a large fee in order to access them. E.g. SYNOP data is only released in chunks based on a limited number of years and a limited number of stations. This makes it difficult to access, even though it is covered by the open overnment licence.

Weather data is extremely valuable to us in Underwriting both for evaluating the output from catastrophe risk models and for creating new models in order to challenge the assumptions of those produce by proprietory vedors.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A standardised format to store all data types would release a large number of man hours expended in formatting each individual file format. This would also decrease the amount of time it would take to teach somebody to use such data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Training needs to be provided at school level in how to access and open these data types. Including training in the practical application and the benefits that can be derived from these products would also be useful.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Many datasets are not used in the insurance industry due to the high cost of licensing these. For example the BGS produce data sets relating to soil types and the risk derived from landslips.

It would be advantageous to the Underwriting team if the BGS were required to licence these data sets for just a temporary period in order for underwriters to prove that they are useful. This means that the BGS data set could be compared and contrasted against other data providers before purchase. This would, in my opinion, lead to a much better market for these datasets where the quality of the data set could be directly linked to the price charged.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Currently the catastrophe risk market is dominated by a few large companies. These models are not validated in any academic journals which leads to a both insurers and reinsurers having to rely on the same model in order to price policies and contracts.

Allowing academics and smaller companies access to high resolution geo-spatial data sets will allow the independent development of catastrophe risk models which can be validated in the open academic literature. An unprecendented degree of competition will then flow into the market as this leads to the models becoming better and more robust.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector organisations need to get together and agree on a standard data format for all of their geo-spatial datasets. When doing so they need to consider how each data set can be accessed by the widest number of possible users.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The use of drone technology to provide increased resolution and detail on the spatial positioning of individual buildings would make a welcome addition. Information on the roof shapes would be particularly useful to catastrophe risk modellers.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector will only co-operate if a clear profit can be realised from such technologies. By controlling any of the infra structure, private companies will be disincentivised to allow access to other members of the community. It needs to be the UK government which invests in the underlying infrastructure whilst allowing the private companies to profit thus increasing the GDP of the country.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

N/A

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Unknown.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Unknown

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

A single UK body should be set up responsible for storing and configuring geo-sptial data into appropriate formats. Standardising not only the datasets but also the documentation that supports them is an important task so that the value from each dataset can be realesed with ease.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Again having a body set up to oversee the collation and standardisation of all uk geo spatial datasets would be helpful in standardising the way in which data is stored and shared.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The development of catastrophe models is an important example of how geo spatial information can be used to good effect in the insurance industry.

Q18: Are there any other areas that we should look at as a priority?

Unknown

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Unknown

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By learning how to utilise geo-spatial data sets and create commercial products from them the UK will gain a technological advantage which it can then export to the rest of the world. As with all technologies it is a race to become the best, be known to produce the best products and have the ability to price them competatively.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The US NOAA catalogue is a good example of how weather modelling data can be accessed for free. ECMWF also provide a good service. For example if I want to download weather obsrvations I have to download these from a US government website. The same information would be likely to cost me quite a bit after paying the Met Office's processing fee.

The situation has got better in the UK over the last few years with the innovation of data.gov.uk but it is still too hard to track down relevant data sets.

Geospatial Commission: Call For Evidence Response Questionnaire

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Lloyd's Market Association (LMA) Exposure Management Working Group
Job title	Text redacted
Address	Text redacted
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	

Individual	
Legal representative	
Local government	
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Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

From a Lloyd's market perspective, we suggest the following digital trends need to be included into the broader categories outlined in the call for evidence.

- Internet Of Things and 'Smart Cities' sensor data
- Mobile tracking / telematics
- Automated Identification System (AIS) ship tracking
- Earth observation (including hyper-spectral, high-resolution optical and high resolution Synthetic Aperture Radar (SAR)

These all have wider implications in the use of geospatial data for underwriting, pricing, disaster mitigationand catastrophe (natural or man-made) event response.

The introduction and further use of geo-temporal data is also a key future driver of value. For example, in the Marine and Energy classes of insurance business, where the majority of risks are in transit, or whose insured values can vary over time.

Further to this we believe that additional steps to open access to data further and to make data more interoperable will foster additional use of geospatial data within the UK insurance industry.

Furthermore, the certainty of the source e.g. definitive addressing / geocoding information) and versioning of data is key to that data being moved around the insurance markets in a more efficient, transparent and fluid manner.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Lloyd's is the world's leading specialty insurance and reinsurance marketplace, which insures risks across a wide range of classes, including property, marine and energy, speciality and liability. The majority of these risks have a spatial context of some kind, either through location of assets being insured, or through being exposed to geographically explicit perils or 'shocks' such as natural catastrophe, geo-political, economic, or environmental disasters.

The LMA's members, who represent the Lloyd's community of managing agents, consume geospatial data in many formats, both in raw forms, but also in derived analytical outputs. This cuts across every activity and function supporting insurance business, including underwriting, pricing, exposure management, claims management, capital provision and regulatory oversight. Increasingly, geospatial data underpins critical analytical functions, especially within the fields of risk management, catastrophe modelling and event response.

Greater knowledge transfer and understanding of data is a key requirement for the Lloyd's market. This is required to ensure that exposure data and supporting information supplied to insurance companies is both appropriate and timely. This would focus not just on technical specialists but also (and more critically) on decision makers on how they use, interpret geospatial data and derived information.

The UK geospatial community could provide greater input to the professional qualifications required by insurers, for example the Chartered Insurance Institute, but also via market-specific career development programmes such as the LMA Academy (https://www.lmalloyds.com/academy). This should be tailored to each level of required technical understanding, and to the needs of each functional discipline, such as claims management. Equally, the Lloyd's market can provide reciprocal insight into the types of products and services which are most relevant to insurers.

In particular, the growth in the use of remotely sensed data, whether via satellite, drone or ground collection, is an area where greater knowledge transfer is required, between technical experts and providers, and the insurance community. For example, the recent LMA / Lloyd's initiative to provide centralised post-disaster Impact assessments via remotely sensed earth observation data has enabled all LMA members to access not only raw earth observation data, but also interpreted damage assessment reports and data via specialist image interpreters.

In addition, skills and services related to the Internet of Things, geo-temporal data (for example marine shipping and cargo), plus demographic and other population and Market data into Artificial Intelligence or other high performance analytics will be a key area for the Lloyd's marketplace in the near future.

While this is a UK focussed request for evidence, our business is worldwide, and we believe that this is a great opportunity to develop UK-based geospatial skills and knowledge which can be applied to global risk issues, and benefit the UK's leading position in an increasingly competitive global insurance market.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We see the following skills needs and gaps from a Lloyd's market perspective:

- Contextualised / application-based training that is fit for purpose
- Interpretation of Earth Observation (Remote Sensing) imagery, full understanding of limitations and uncertainties by sensor.
- GIS is widely used in its simple form, e.g. Google Earth, simple overlays, map creation, and there are some companies who have invested in more sophisticated geospatial capabilities, for example setting up GIS teams and in R&D capability, but the industry does not consistently apply spatial analysis and inference techniques on a day-to-day basis.
- General use of GIS for spatial analysis, mapping, information products etc. And GIS systems often available in companies to some extent, e.g. MapInfo, ESRI, QGIS, SQL but lack of skills and understanding result in it hardly being used beyond simple operations
- Raise awareness of open geospatial datasets to complement commercially available datasets
- GIS needs to be more integrated in the day to day operations of modellers and underwriters, and to understand how spatial data can support decision making etc.

There should also be a focus on the positive impact that GI/Earth Observation can make to the Lloyd's market. This should be independent of the means required to deliver it – focus on "what" geospatial / Earth Observation can do for different insurance processes and the "how" can then follow.

Greater integration of geospatial capability into risk models, particularly catastrophe models, would also be of particular benefit, especially in relation to open source models such as the OASIS Loss Modelling Framework (https://oasislmf.org/), to improve calibration and validation of model outputs.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

From a Lloyd's market perspective, this is a global challenge, and the quality of available data can provide a significant limitation to the confidence which may be placed in the information and analytics applied to assess risk. In particular, the quality of location references, including geocoding and property databases, can be poor or incomplete. Improved access to 'authoritative' cadastre, asset registers, or other higher resolution data to locate risks more accurately, will improve the granularity and confidence in model outputs.

Access to public asset data, including infrastructure, would also be of great benefit in improving risk assessment confidence.

With respect to access to data, there are moves in the Disaster Risk Reduction/Insurance world to build portals providing access to free/commercial data e.g. Oasis Hub (https://oasishub.com/). It would be beneficial to see government interacting more with these entities to collaborate and provide input into them sharing best practice around usable open standards for geospatial data access. In particular, the Insurance Development Forum (IDF)'s current work on developing exposure data standards is one where there is the potential for government interaction.

Specifically, around property information there is a need for high resolution data needed, from a variety of sources including census, valuation office, all linked via unique address identifiers, ideally open access for use in commercial activities. Use cases include exposure enrichment, exposure development, insurance risk pricing, automated insurance placements etc.

As part of government and the engineering sectors thinking about Smart Cities and Building Information Modelling, there is a need to consider the geospatial assets behind these themes and how insurance can play a role in the life-cycle

management of buildings. Purely from a geospatial data point of view there is a need for more accurate 3D building data and underground assets data

Further, the Insurance Development Forum (IDF) is actively discussing open standards around exposure data schemas, which are essentially underpinned by geographical data. There is potential for geospatial data standards (e.g Open Geospatial Consortium) to feed into creation of exposure data standards.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We feel there is benefit to incorporate the FinTech/InsurTech communities and how they are using address information to build faster and more efficient processes. There are many themes to consider:

- Links to other thematic data, e.g. census, to enable data enrichment processes, data accuracy assessment (e.g. for catastrophe modelling primary characteristics such as occupancy, building height, age and construction and other building information modifiers)
- Managing customer data, identifying customer behaviours, interactions and preferences, segmentation, customer support, personalised marketing, customer lifetime value, i.e. how much value will a business derive from their entire relationship with a customer, recommendation engines – this is applicable across many private sectors, also thinking automated insurance risk placing etc.
- Effective risk modelling, through improved accuracy and more information, and therefore better data-driven decisions. We can see this flowing through many areas of re/insurance business, not just natural catastrophe, but underwriting risks in general
- Real-time and predictive analytics, e.g. responding to risk event, e.g. natural catastrophes, cyber events, etc.
- Internet of Things and the subject of connectedness – with implications for cyber security but also to buildings and other physical assets.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Lloyd's market is making increasing use of earth observation data across a range of activities. For example, the recent Lloyd's and LMA initiative to provide centralised post-event data and intelligence services, primarily for claims management, has been well-received in the marketplace. Specifically, the ability to quickly obtain this data, enabling an early assessment and immediate claims settlement post an event, which is a target of Lloyd's and the individual Managing Agents. Recent LMA events have highlighted the growing, but largely latent, value of earth observation data to support insurance risk assessment. In particular: more focus is needed on information which the insurance sector will use rather than raw data outputs which need further interpretation by experts (who may not be employed by an insurer).

Insurers would be more willing to subscribe to these information services which are targeted to specific problem spaces. Work has been done by independent bodies such as PERILS (https://www.perils.org/) to allow access to exposure and loss information across the UK and Europe. This could be expanded to common access to geospatial information products with the backing of governments as a data source/aggregator.

Other examples can be found from the development world, World Bank, United Nations and the Sendai Framework. For example, the Group on Earth Information (GEO) is working to improve availability, access & use of EO data (with 105 members world-wide), e.g. Geo Darma provides data access for Risk Management. The focus is on sustained end-to-end solutions.

Added to this, there is a need to raise awareness of professional accreditation, again, via bespoke career development activities.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

From an earth observation perspective, micro-satellite SAR constellations with multi-band and polarity would be a priority allowing very high temporal revisit frequencies, especially to capture rapidly developing events, such as flood. These have applications as far reaching as event response, claims analysis and parametric insurance for agriculture.

A focus on insurance technology (Insurtech) would be useful – to learn what small start-ups are doing in this space with many using geospatial techniques and accessing geographic datasets. Many start-ups are also developing exposure datasets on a global basis. There is a need for knowledge transfer between the start-ups and geospatial commission to look at best practice, standards, training and education around the use of geospatial in insurtech.

There is also the need to bridge the gap to geospatial non-experts who may use spreadsheets, databases and data visualisation tools but not have a much-needed awareness of the spatial components to data and information.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The Lloyd's market is a leading supporter of innovative data and analytics products for insurance. The first cohort of Lloyd's Lab startups and InsurTech entrepreneurs will, in many cases, make use of spatially reference data to drive their products and services. This is very likely to be the case for those which follow. An increased awareness of the types of data being made available is therefore key, and improved understanding of the geospatial community to the specific needs of insurers for data and tools to support disruptive technologies and products would also be of great benefit.

Greater collaboration, mutual understanding and identification of opportunities, will only benefit both the UK insurance and geospatial sectors.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

By supporting sectors such as insurance with a consolidated set of geospatial assets this would lead to efficiency gains and an increase in the use of geospatial data. Through public sector investment there are a wealth of reciprocal benefits which can come back to public sector from private industry. For example, though value added data, additional insights etc., as well as societal benefits in the form of better and cheaper access to insurance products, and in relation to contract certainty, which aims to better protect insurance customers.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Access to high resolution GPS is increasingly critical across all areas of geospatial data provision in our industry. We need to retain -UK's access to high precision and guaranteed GPS, and to monitor at how future higher precision GPS location data could be used to develop new and innovative insurance products. We also need to exploit as much as possible, smart IoT data, and human sensor capabilities. There is a link to disaster risk reduction and humanitarian response and how data collected on the ground in a disaster-prone or affected area can be used to help calibrate, augment and improve assumptions relating to risk modelling and resilience.

The Lloyd's market is a key supporter of Disaster Risk Financing (DRF) insurance, and can provide a valuable source of knowledge and insight to geospatial data providers when they are developing products and tools to support these activities around the world.

There should be more awareness of social media and individual people-sensors and how to engage and integrate personally collected data to improve for instance, catastrophe model vulnerability / exposure assumptions. The effective utilisation of social media and other 'real time' data sources will become increasingly important, particularly in respect to parametric insurance products where accurate data is required to validate the 'trigger' mechanisms which can initiate payout against particular types of events, but requires careful assessment and product design to ensure it is appropriate and be beneficial to insurance risk assessment.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The LMA is a collaborative organisation, and we would suggest that there should be a wider alignment of the geospatial community, and Lloyd's market members via LMA activities and groups. This could work on a range of issues and opportunities, including knowledge transfer, data standards, product and systems design and development, and product innovation. In addition, the role of Lloyd's Lab and InsurTech groups will be critical going forwards.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The main challenge is being able to identify and assess use of the data which may be available. The lack of centralised repositories or portals, to enable easy and controlled accessibility to data and other products, limits the use of these data by the market. Again, data standards are increasingly important in the insurance marketplace – recent initiatives to develop improved exposure data standards would benefit from greater input from the geospatial community. Increased interaction / collaboration between the geospatial community and the insurance market, via existing, or potentially, new forums, would be of great value.

In addition, costs of data can also be a barrier to use, especially in respect to detailed data, which can have prohibitive licencing costs, or restricted access. In terms of interoperability, the Lloyd's market is a major promoter of the OASIS Loss Modelling Framework, and this should be considered as a potential collaborative resource for improving the integration of geospatial data into insurance risk functionality.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

From a private sector perspective, making sure it represents the needs of the end user communities and provides that central, proactive, centralised source whilst engaging with learned societies and organisations that try to help bridge the gaps e.g. UK innovate, Satellite catapults, Natural Environment Research Council etc.

The Geospatial Commission could act as a 'stamp of approval' for data sets, ensuring fitness for purpose and adequacy for the specific tasks required.In addition, as a promoter of the use of geospatial data within the insurance and reinsurance industries, in collaboration with the professional bodies, and potentially helping to lower barriers to entry, cost and expertise.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As previously noted, the Lloyd's market is an active and growing user of geospatial data and derived products, across many areas. The continually evolving, and diverse universe of risks which the market insures, means that is almost impossible to define what sort of datasets might be more or less useful into the future. However, the trend for increased risk assessment granularity, 'near real time' event monitoring, and understanding of complex and inter-dependent risk systems, means that the market's demand for data will undoubtably increase, and rapidly.

We would however, highlight the following as key areas for access to geospatial data:

- Geocoding and address location data
- Detailed population and geodemographic data
- High resolution (both spatial and temporal) earth observation data, especially SAR, which can improve event assessment
- Property valuation data
- Greater access to government data including infrastructure, crime, traffic accident and other incident data
- Telematics data, port inventories and other time varying data

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Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

There should be greater alignment between the strategic direction of the Lloyd's market, and its members, and the overall strategy for geospatial data, both in terms of data acquisition as well as data products. The Commission may be a forum for developing these links.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The LMA would not see this is a major concern, but more generally, data standards and the need for collaborative data sharing continues to critical to improved application of geospatial data in our industry.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The insurance industry and Lloyd's market in particular, will have interest in all the above. Some evidence use cases would be helpful. The call for evidence document has listed insurance pricing and the Geospatial Commission should also consider disaster response, claims management, customer-centric insurance solutions, new insurance products through smart home technology to lower premiums and insurance costs, risk management and transfer of solutions, data and analytics to identify new solution to bridge capital with new & emerging risks. The insurance sector body could be the liaison between the commission and the insurance industry to look at collaborative efforts to build partnerships.

Q18: Are there any other areas that we should look at as a priority?

As noted above, the insurance industry makes use of geospatial data across many functional areas, including underwriting, claims, modelling and analytics. There should be a focus on the use of geospatial within insurance and the work done from within the insurance industry to contribute to resilience in the face of climate change. Work done by the IDF (theidf.org) and others in the industry has a large geospatial component and should be investigated by the Geospatial Commission.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Insurtech should be the focus plus rapid response EO / sensor data. There are potential challenges from financial and insurance regulators, especially when relating to capital management, new insurance products etc. where the use of geospatial data and technologies underpin the modelling behind the solutions.

Another policy issue to consider is GDPR in terms of how data is used, shared and individuals knowing about this. Data privacy is a concern.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

As noted, the LMA represents an industry sector which operates across global insurance markets. The role of UK geospatial expertise in the provision of the acquisition systems, platforms, tools and data products is significant, and this aligns well with the world leading position of the UK insurance industry. In particular we highlight the following areas where a relationship between the insurance industry, including in the Lloyd's market, and the geospatial community, could further develop influence and visibility:

- Investing in high resolution spatial and temporal EO, especially SAR and hyperspectral capabilities.
- Developing capabilities for insurtech exploitation of spatial data, which can be used both in the UK and internationally
- Developing human sensor capabilities to improve risk assessments and

claims analysis

- Leading centralised data services for multi-sector use
- Leading in applied research, and journals and publications
- Leading in product innovation
- Leading in data access, best practices
- Focussing on public relations: sharing of success stories, visibility to the public, launch a campaign to raise public awareness, link with themes that are important to the common person (how is this relevant to someone you stop on the street?)
- Promoting and making available more open (free) data which will drive wider innovation and commercial use
- Investing in engaging with the industry to gain a sense of the possible and what is needed to get there

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We believe the following international organisations could be looked upon to provide exemplars of best practice:

- World Bank, UN, Red Cross – all innovators in the use of geospatial data.
- ESA and Copernicus and the Disaster Charter
- Open Geospatial Consortium
- US Government data sourcing
- JRC and EU-wide, cross country initiatives such as EFAS (European Flood Awareness System)

The use of geospatial data in the insurance sector could also be discussed in forums such as UN-GGIM to discuss overlaps with disaster risk reduction and climate change initiatives.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Location International Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**
Other - please state	

About Location International Ltd

Location International Ltd provides strategic advice and full operational capacity globally, to the public and private sector, as to how to gain from improving their own use of location information to enhance their decision-making and to meet the ever-changing needs of their customers and stakeholders.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definition of geospatial data given would not be instantly recognisable globally.

The collection of 1-4 could be renamed as 'geospatial information' and 1 and 3 could remain as written. Globally the term 'positional data' used in 2, normally refers to data collected by GNSS or to GPS data. It is clear that is not what is termed here and so perhaps the definition should be renamed to avoid confusion with the global norm. This has been named in the past as 'geospatial exhaust data' or 'secondary geospatial data'. The term Geospatial Services used in 4 should perhaps be more reflective of the industry and could be "geospatial intelligence products and services".

A broader definition for geospatial might be agreed by the Commission. One of the major issues holding back the global geospatial community is a lack of understanding by everyone else, of the term 'geospatial'! For a written piece for a Global South audience in June 2018 I defined it as follows:

"The term Geospatial encompasses both earth observation using satellites and other remote vehicles and those activities in data analytics using statistical and geographical frameworks, embracing all the new ways of analysis of the associated data, including those undertaken by machine learning and deep learning.

The resulting geospatial information outputs enable improved decision-making in both the public and private sectors and in both the developed world and the global

south, leading to better performance and improved use of resources. Good examples can be found in all economic sectors, including health provision, government, transport, financial services, agriculture, construction and in innovative new services; all of which contribute to both improvements in operational efficiency and wealth creation."

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The Commision should focus on capacity building. There is an ever increasing demand for 'capacity building' globally following the rapid global growth of the use of geospatial information. The lack of well-trained professional and technical people in the area is one of the major factors limiting the growth of the sector world-wide.

There is a requirement for training that is not focused simply on the 'buttonology' of vendor courses where the emphasis is specifically aligned to operating specific items of hardware and software; but instead on developing a greater understanding of the subject areas.

Outside of this training, geospatial skills development currently takes place in three areas in the UK:

1. Masters courses in GIS; feedback shows that many of these courses do not give the modern grounding needed by the majority of employers as they are not focussed on the computer development software skills but more on the computer vendor package operator skills. As more users move to open source software useage this grounding is inadequate.

2. Geospatial apprenticeships: These have commenced https://www.tsa-uk.org.uk/government-gives-go-ahead-geospatial-apprenticeships/ but little publicity has been given to them and once again early feedback shows people are more likely to accept an apprenticeship in a mainstream subject such as Engineering rather than geospatial as it is thought the future job opportunities are greater.

3. On the job training: The majority of this is taking place in the public or third sector. Due to the skills shortage, it is being reported that as soon as someone is trained, they move onto a better paid role in the private sector.

Geospatial analysis is used in many subjects at University (e.g. Engineering, Geography, Planning, Health Care, Archaelogy to name a few) as can be evidenced by the huge useage of geospatial data supplied by the JISC contract. Geospatial skills need to be taught today as a basic skill to all those entering

Higher Education but it is necessary for Data Scientists and general Computer Scientists to have geospatial modules built into their curriculum as they are in other countries. This will promote a reduction in the level of expensive, difficult to recruit specialist skills and expertise needed in the end-user community which is currently preventing geospatial becoming universally adopted as it will mainstream the subject area into IT.

It is pleasing to see that 'Geography' is now a profession within Government and this will give those involved a platform to improve the awareness of the importance of geospatial in their departments and agencies.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Careers in the sector can be better promoted by better communication skills being available within the industry, modern supporting material being available about the use of geospatial and a better understanding that 'everything happens somewhere'.

Most organisations wishing to use geospatial effectively in a professional production environment require software engineers with geospatial data analysis skills and relevant domain knowledge as described in Q2.

Key skill requirements include:

- Geospatial strategists – very few exist and hence too many times discussions involving geospatial work is reduced to technical, non-strategic discussions
- Experts in big data analytics and the application of machine learning and artificial intelligence to geospatial data and in particular earth observation data.
- Developers and software architects with geospatial data processing and applications development expertise
- Geospatial project managers

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

It would be helpful to have a freely available cross-reference table between all the common identifiers that relate to 'place' used in government e.g. UPRN, USRN, TOID etc.

It would be helpful for the UK to decide upon the national geospatial data stack

and ensure that each of those datasets are fully able to be maintained to the desired quality, to be licensed in a uniform way and accessed by both the public and the private sector for reuse. This is the norm in many countries and is known to drive economic efficiencies for both the public and the private sectors.

It would also be helpful if there was a national geoportal; this also is the norm in many countries and facilitates data being collected once by the public sector (and their contractors) and reused many times. This does require though a more mandated use of Open Standards based on the published ISO geographic standards and the published OGC standards.

Finally, much emphasis to date by the Commission has been given to making OS MasterMap an open dataset. This is an unusual choice by global norms as most countries have no equivalent. As most users now look for global exemplars when making investment choices, the current emphasis is surprising as it will be very complicated to manipulate and most users who are innovating new applications will not have the capacity to deal with the complexity of the data structure.

In most countries, the key reference geography that people wish to have 'open' as it gives greatest commercial and public good value is:
a. a regularly updated stream of earth observation data derived from satellites, HAPS or aerial collection
b. a comprehensive and maintained address dataset if it exists or a proxy for this dataset
c. a hazards dataset to assist universal use and awareness by the nation in preparation and during hazard events e.g. flood events

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A revision of the Address Standard BS 766 would be timely with reference to work being undertaken in ISO TC 211 to support emerging technologies and also to take feeds from third parties.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK is already known globally as a leader in Earth Observation and has been for the last 40 years. We must ensure we embrace all the new technologies ensuring we develop suitable government policies with industry for the use of not only Satellite data but also HAPS, drones and aerial imagery. Over the last 10 years, the Daily Mail newspaper has run stories about 'spies in the sky' and has created negative public reaction to these new technologies being used by government. Most countries have a definitive published policy and to date this has never been in place in the UK. Today one cannot stop anyone or any country looking at anything and it is important that with this knowledge, the policy is developed and published.

A key role for the Commission would be to organise and coordinate the UK government's needs for geospatial information – essentially acting as 'intelligent customer' for geospatial information services on behalf of the UK public sector and extending this agreement, if possible, to the third sector. This is already enabled for some key datasets but it should be extended so that the Commission is the 'central procurement hub' that can articulate clearly their needs.

It is well known that Great Britain is a leader in the production of geospatial data from the six named agencies mentioned in the Consultation. Interestingly, we have many national and non-national suppliers of aerial imagery and no national suppliers for satellite earth observation imagery. This situation is globally unusual. There is normally much more 'national control' over aerial imagery companies either by ensuring they are nationally owned or by ensuring that certain national personnel must be on board in the planes when imagery is being collected.

With the development of HAPs, the exponential increase in the collection of high-resolution satellite data, these 'national controls' are becoming worthless. However, many nations are now choosing to invest in their own national capacity for HAPs and Earth Observation satellites so they can control their output both over their own nation[1] and what they choose to view over other nations. This is something the Commission should consider co-ordinating for the UK.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Artificial Intelligence and Machine learning are becoming central to the

[1] Due to cloud cover only radar earth observation satellites will be of use over the UK

exploitation of geospatial data in the most advanced economies. Currently in the UK, a few SME companies have been working to develop training datasets for Machine Learning but as Geospatial is not seen as a priority of the nation, unlike nations in the Far East, we are not growing as rapidly in this arena - despite as a country being one of the leaders in this technology via DeepMind and others in this sector.

The relationship between 5G, smart places and geospatial should not be overlooked and hence a focus being given by the Commission to artificial intelligence, machine learning and 5G in the sector would be most helpful and will accelerate the use of geospatial in many areas. It is also likely to unlock certain industries that in this country have not yet entirely embraced geospatial data analytics such as the financial services sector.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

To support enhanced roll-out of future technologies, it is essential to improve the awareness of the power of the use of geospatial and how it is an underpinning co-ordinating infrastructure (sometimes illustrated as the backbone) of any new data driven technological environment.

It is currently deployed in 'silos' in the UK unlike some other countries and so one can see excellent use of it being made in transport, agriculture, health, energy etc. but its use is not universal mainly due to the lack of awareness and the human capacity issues already mentioned.

Having improved awareness, accessibility to geospatial data is a vital component and hence a national portal is vital. This should not be a repository of 'all data' but just a light touch wrapper that connects to Departments and Agencies to return to the customer either the service or product they require instantaneously.

All data collected in the future needs to be:

- Fully interoperable and hence mandating the use of international Standards in each future procurement of geospatial data by the public sector will improve the ability for data to be reused and repurposed to support future technologies.
- At the same time, the intellectual property rights management in the acquisition of geospatial data is a vital skill that must be understood by those in the public sector geospatial community whose duty it is to acquire datasets for the public sector.

Universal national usage of geospatial is something many countries are achieving or plan to achieve within the next 36 months. It is surprising that the UK is the home of some of the best data in the world but yet due to historical reasons, geospatial data has never managed to be viewed as being an essential

part of the UK infrastructure. Hopefully the work of the Commission will now achieve this and hence geospatial data and applications will assist the adoption of future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Many public sector organisations collect data; some undertake the collection as their main task and for others it is a by-product of another aspect of their work.

It would be helpful if the Commission could relook at the national need for geospatial data so that the nation has like other countries a comprehensive underpinning geospatial infrastructure framework. Hence instead of these datasets being 'producer led', they become 'customer led'. This would then assist the Commission to:

1. Define what are the essential datasets for the nation that must conform to international standards for interoperability and accessibility
2. Define the specification of the geospatial portal and which datasets are within it and those that are not
3. Define the future maintenance regime for each dataset and be clear as to the acceptable quality standard for each dataset.
4. Define the annual financial investment needed for each dataset which can either be invested by the organisation in return for a revenue opportunity or invested by government so that it can be free of charge at point of use. The key aspect that must be considered is 'someone has to define the specification and then financially pay to maintain currency and maintain quality'. Unmaintained data quickly reduces in value to everyone.

Many public sector organisations in the UK invest in maintaining their own geospatial data sets. This is a rare business model around the world; many equivalent organisation now act more like a regulator as they only:
1. create the conditions for data to be collected
2. define the acceptable quality of a dataset for the nation
3. monitor a private sector contractor to collect the data using ISO 19157 that establishes the principles for describing the quality of geographic data. It

- defines components for describing data quality;
- specifies components and content structure of a register for data quality measures;
- describes general procedures for evaluating the quality of geographic data;

- establishes principles for reporting data quality.
- defines a set of data quality measures for use in evaluating and reporting data quality.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Access to high integrity and high precision GPS/GNSS signals is an essential part of a modern economy and can be seen to take considerable cost out of many essential industries of nations.

Ordnance Survey like many other similar organisations around the globe has developed a well-maintained geodetic network called OS Net. Unlike many others though they have managed to run it as a 'managed service' for many years so ensuring that the investment in the equipment can be maintained. However, despite OS Net being an essential backbone for its own activities and also the activities of the emergency services, it is under utilised by other sectors. It is a national asset and should be invested in further to increase its cyber resilience and general capacity and promoted as an essential part of the national infrastructure that should be reused universally by the construction industry and others needing accurate positioning in their daily occupations.

Indoor positioning technologies is becoming the norm in many countries but I cannot think of any that have been 'government sponsored'. This work tends to be led by private sector companies who wish to 'sell services and augmented reality experiences' once inside a building.

The other aspect that should be considered is the role of the Commission in the buried services/underground assets community. This is an area that most governments intervene and it is very much normally a government-led area to ensure that overtime the underground assets become better organised than over previous decades. In the UK, the work has been led by NJUG http://streetworks.org.uk but as a Trade Association they perhaps should have an affiliation with the Commission in the future.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector clearly often articulates that they would like to provide more services to the public sector; but with that comes the added responsibility for maintaining the nation's infrastructure or providing services to it.

To date there has been insufficient investment by the UK owned private sector geospatial companies for them to actually be significantly large companies to take on such a responsibility and hence the overseas private sector companies often benefit.

Naturally the argument can be made that procuring from the private sector would encourage further private sector investment for the benefit of all but to date lenders have been reticent to invest as once again the lack of awareness of the power of geospatial has meant they are more likely to invest in more mainstream technology companies; hence most UK-owned geospatial companies have turnovers of less than £10M per annum.

Many nations think about creating such entities from their own public sector companies and making them Government Owned companies with a plan to eventually grow other business outside their own nation's responsibilities.

To date though there are no example success stories globally for countries that have tried this to date. Failure has occurred as the entity that becomes a GovCo, which is outstanding at creating, and maintaining the nation's geospatial data does not have the culture in the operational staff to become agile enough to attract other substantial business. In the cases that have tried this business model, management have been keen but it has been the operational staff who are the 'heart and lungs of the organisation' that have been unable to make the transition.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Geospatial data from across the public sector should comply to the EU INSPIRE guidelines. Even though the UK is leaving the EU, it would be a most unusual decision for the UK to abandon these guidelines as nearly 90 countries around the globe have adopted them as 'best practice' even though they are only mandatory via the EU Directive to the EU nations. By complying to INSPIRE guidelines, one authomatically is adopting 'best practice' for:

- the interoperability of datasets
- the accessibility of datasets
- the use of international standards (ISO, International Hydrographic Organisation (IHO) and OGC standards)

A single accessible 'light touch' portal for UK government geospatial data as mentioned earlier with e-licensing in place would increase the useage of the data and reduce the burden on all users from the public and private sector to access the geospatial data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission can act as a more effective customer for geospatial data on behalf of the public sector by:

- identifying areas of duplication or overlap, so that relevant geospatial data can be acquired once by government and used multiple times. This is a problem for all governments until they look at their geospatial data in a holistic way – a recent example being one country with 14 different government departments collecting the coastline of their country to 14 different sets of guidelines; resulting in 14 different versions being in existence, 14 teams of people duplicating work and 14 IT infrastructures being maintained.
- being the procurement hub for geospatial for the pubic sector and possibly the third sector
- helping to frame the final requirement for certain datasets e.g. for height data, what is required - is it the height of land, average height of building, height of roof line etc.
- improving the understanding of the use of geospatial in the public sector and the private sector too
- differentiating the geospatial sector from the 'big data economy' but ensuring it is seen as an essential element of this economy
- being transparent to industry, such that industry can work with government to plan its own development and associated investment
- ensuring there is sufficient diversity in the requirements that both medium and large companies can tender rather than the medium sized companies always having to work through a large company which can jeopardise their growth

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant

benefit from having access to, that might have novel and valuable use cases? What would that access look like?

This is a tough question to answer unless one has thought through the need and also how government in future wishes to use data.

Geospatial data in the UK comes in many forms often today created from 'exhaust data' from other applications e.g. from mobile phone data, from company account data, from repurposed public sector data.

The quality is variable but is used extensively by the private sector for predictive analytics to 'consider potential behaviours'. The Commision might care to assist government to think through how much it chooses to 'itself' undertake this locationally based analysis on the citizen to hone public services and reduce public sector costs.

An alternative which reduces the reputational risk to government is to buy the answer from the private sector as a service or to encourage the private sector to publish the data outcomes onto which the public sector can build policy-based initiatives.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The Geosptail Commision can really make a difference if it stays at a high level but ensures it measures and monitors those aspects that it strategically gives guidance upon.

It must work with the relevant stakeholder organisations both within the devloved adminstrations, the national organisations and with the representatives of the private sector. It is likely to cover aspects of:

- Organisational governance
- Standards to be adopted
- Capacity building
- The nationally needed geospatial data stack
- The portal by which it should be accessed

The Strategy should aim to maximise exploitation and benefit to everyone from geospatial information and to provide a framework to guide national, regional and local geographical initiatives.

Currently too few government owned datasets that incorporate location can be easily assembled and analysed with reliability from across local and central

government bodies. There remains:

- too much duplication,
- too little reuse
- too few linkages across datasets

The Strategy should ensure that:

1. we know as a nation and as citizens, what essential data we have access to, and avoid duplicating it
2. we use common reference data so we know we are talking about the same places
3. we can share location-related information easily through a common infrastructure of standards, technology and business relationships
4. we have the appropriate skills, both among geographic professionals and among other professional groups who use location information or support its use
5. we have strong leadership and governance to drive through change including the implementation of the Strategy

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Local Authority co-ordination could be assisted by senior leaders in SOLACE and in COSLA. It also would be possible to improve effectiveness by using at the grass routes operational level, those that work in local government to provide GeoPlace with the local government inputs to the national addressing products.

Clearly, financial burdens must not be imposed on Local Government by the introduction of the Strategy but there are many incentives for them to use geospatial as many of their shared service centres already strategically use geospatial in everything they do. There are great individuals who are advocates for cost reduction by the use of geospatial in Local Government and they should be used to spread the word both to the CEO level and to the more operational staff.

The national Strategy priorities will easily translate to Local Government and hence including senior representatives in the major initial discussions on the following priorities will be essential:

- Organisational governance
- Standards to be adopted
- Capacity building
- The nationally needed data stack
- The portal by which it should be accessed

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

This list seems a little constraining as geospatial could be used in so many different economically stimulating examples. I also would have thought it is for the market to develop suitable applications as opposed to government.

However, taking mobility and being very involved with encouraging disabled people to meet their full potential, I am very pleased to see that the National Rail system will have a new geolocationally enabled app https://www.bbc.co.uk/news/uk-england-45656560 and I would also encourage greater investment in this website which is underfunded but would assist greatly if further investment could be found https://accessadvisr.net. For the record I have no financial or personal investment in either [text redacted].

Q18: Are there any other areas that we should look at as a priority?

The Geospatial Commission should perhaps lead on international engagement in geospatial matters. Currently the UK involvement is fragmented with UK representatives attending multiple international fora as the 'UK government representative' but it is not clear if a knowledge of all aspects of developing international policy is being fed back and utilised by the UK government.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are many potential public and private sector innovations that will rely on geospatial data and many that have not been invented yet. Five years ago we would not have thought the commodity trading prices can be affected by 'our industry'.

Potential regulatory challenges include:

- privacy issues including confidentiality of geospatial data that may allow individual identification;
- security issues about the collection and use of geospatial data
- regulation around the use of drones, autonomous vehicles, HAPS and other aerial platforms to collect geospatial data;

Q20: How best can we make the UK's presence in the international geospatial world more visible?

A great first step is the formation of the Geospatial Commission and the information you have supplied to date; this is attracting international attention.

Continuation of quality information generated from the Commission is essential. To date the UK has been 'behind' other nations in the fact we did not have a central co-ordination policy body unlike many nations in Europe, the Middle East, the Far East and North and South America.

The strategy and resulting policy should be published so that it can be studied and copied around the world.

The Geospatial Commision should become the lead 'policy unit' for geospatial for the UK and hence be the lead UK representative on international policy development.

The Geospatial Commision should work with DIT to assist them to embrace the export potential for the UK geospatial sector and we should be penetrating markets currently being dominated by the Republic of Korea, China and occasionally France.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Different countries demonstrate different aspects of best practice. No one country acts as an exemplar country.

The Nordic nations: best exemplar of devolved governments working together. This good practice is further exemplified in the Arctic SDI which has a most complicated set of countries to co-ordinate but they have used the same working practices as amongst the five nations of the Nordic SDI.

Denmark: best example of measuring the 'monetising' of Open Data

Norway: best example of local and central government working together and deriving benefits from each other

The Netherlands: good example of land registration and the geospatial framework being governed together but using Geonovum, an external body to support the implementation of best practice across the country

Abu Dhabi: a good example of 50+ organisations within one government working together to adopt the same practices and ways of working to reduce cost and improve interoperability and reuse of the data

Republic of Korea: Good example of how to attract inward investment and good example how to influence other nations to adopt their practices and sell their expertise

Singapore and Hong Kong: good examples of how the whole nation is underpinned by well maintained geospatial information

Australia: good example, despite until recently they not having a Space Agency, how they have embraced due to the size of their continent the advantages of the use of earth observation data and expressed this by moving forward on their DataCube approach

Regional centre for mapping rural development (RCMRD, Nairobi): a good example of how to get common working practices in capacity building operational across a complex region

Mexico: a good example of excellent co-ordination between their statistical and geographical frameworks, which are managed in one organisation, called INEGI. At the same time the Mexican government has shown excellent co-ordination skills to assist the building of the geospatial frameworks of the Latin American countries and also the Spanish and Portuguese speaking Caribbean Countries and in the much-needed provision of capacity building for both regions.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Mallon Technology Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Data analytics, machine learning, AI, access to data, data interoperability

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- Data science and machine learning skills are in short supply.

- Promote STEM at school level – events such as international GIS day and Space week can help engage schools
- Introduce schools to earth observation data (Copernicus programme)
- Promote industry opportunities to data science graduates, through placements, internships
- Introduce geospatial/earth observation post graduate programmes to data science undergrads.
- Establishment of apprenticeship programmes

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Current challenges include clarity of rights and accessibility. Lack of awareness within local authorities with regard to what data is captured/retained/managed across departments. As a result, it is difficult for third parties to source and access this data.

A central data sharing body or clear policy on data sharing could deliver transparency, facilitate sharing, implement standards and ensure data interoperability

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A single national address register will assist with linking a wide range of other data and assist with building value added services on the back of a single register

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- Improve access to high-end computing facilities. Develop skills in scripting, mathematics and machine learning.
- Enagement with between Private and Public Service to promote the use of Earth observation data to aid planning, monitoring and change detection. It can be used in emergency disaster management, monitoring climate change, flooding, coastal erosion, urban planning etc
- Access to funding streams for collaborative research and development – clear guidelines on retention of IP for SMEs when collaborating with research bodies

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Platforms as a Servce (PAAS) – mechanisms for providing earth observation data /data cubes/satellite data archive to users. Organisations can build algorithms and create a value added service on top of such platforms.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications can form the cornerstone of many applications by enhancing data visibility and context, aid decision making, research, geo-targeting, geoAI etc

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Platforms for data access, develop products and services for social, economic, educational and business use. Maintain data quality standards, regular updates/data validation, positional accuracy, engage with users, promote the use of national mapping and related databases.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Geodetic networks and frameworks

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

More effective collaboration, private sector can assist with driving innovation and provision of expertise

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges include clarity on data availability, what is freely available for use and how to source it.
Data standards and data interoperability issues

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By communicating the value that geospatial data can bring to enhance public services and social engagement. Assisting with knowledge transfer to local authority users to foster adoption and awareness.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Copernicus data (Optical and SAR) can provide significant benefit to the public sector. Accessing this data through a PaaS/data cube.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Include Geo in other national strategies including the national data strategy, national innovation strategy, national space strategy etc which will help align the single UK strategy at the core.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Through collaboration, regional investment, shared services/knowledge and policy that requires local authorities to engage with the citizen.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

GeoAI for sales and marketing category

Q18: Are there any other areas that we should look at as a priority?

Healthcare

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Using earth observation data on a national scale for monitoring agriculture, food production, monitoring climate change, security etc

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Promote FDI and create clusters to foster innovation, ensure that there is a diverse and large pool of talent. Government funding for R&D and collaborate internationally.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

USA for sales and marketing innovations

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Mansons Property Consultants ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
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Other - please state	

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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We do not have sufficient expertise to provide input.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We do not have sufficient expertise to provide input.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We do not have sufficient expertise to provide input.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One million property transfer transactions are registered at HM Land Registry every year, a further 34% of transactions don't make it to completion mainly because of the delays in the process and information which comes up after the sale is agreed but which would prevent the buyer from proceeding either in relation to the property or the funding required for the purchase.

HM Land Registry data is inaccessible other than the basic information. The digitisation of documents held by them would help process key stages in the conveyancing transaction and provide information to a potential buyer in a digestible format prior to viewing.

Stamp Duty Land Tax data is submitted to HMRC on the transfer of a property but this data is currently not accessible to HMLR or the conveyancer. On the sale of the property this data could prevent seller identity fraud because the conveyancer and HM Land Registry could verify data such as the National Insurance Number,

dates of birth, etc to establish that the person they are dealing with is the genuine seller.

Similarly, providing HM Land Registry access to the DVLA and Border Control data would enable them to affix an official photograph of the Registered Proprietor to the Registers so that anyone transacting with them could easily ensure that they are dealing with the true owner.

Water Authority data is also inaccessible other than through Water Authority Searches. This causes additional costs burdens where only core data, such as connection to mains water and drainage and the route of pipes and sewers, is required but the consumer has to pay for the full search product which includes information irrelevant to the conveyancing process eg water pressure, etc.

Similarly, the exact route of drains and sewers would be extremely helpful to property owners when considering extending or altering their property and therefore with no need to carry out a full Con29DW drainage and water search.

Survey and Valuation datasets held within the private sector could also provide valuable information during the conveyancing process.

Obtaining information, held by both private and public bodies, relating to the management of Leasehold estates or managed Freeholds adds an additional 20 days to the conveyancing of these properties. Having immediate access to these datasets would inform potential buyers of their financial obligations prior to viewing and offer, and reduce wastage through transactional failures and delays.

There are issues with the quality of planning and building regulation data dependant upon the systems used and accessibility permitted by the Local Authority. Whilst the planning portal is a helpful asset it is hit and miss. Enabling access to the datasets would speed up the home moving process whilst at the same time making the planning process more transparent and providing valuable information to emergency services on changes and access to the building.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data and the identification of land and the buildings located on it is currently flawed. HMRC work off the UPRN for the Stamp Duty Land Tax Return but HMLR use their Title Number. There are difficulties where the taxonomy of flats is non-standard so that a Ground Floor Flat might be described as GFF Acacia Avenue or Flat 1 Acacia Avenue, Flat A Acacia Avenue or Garden Flat, Acacia Avenue.

Changes will therefore need to be introduced to either standardise addresses or link them to one agreed unique identifier which should be attributed to the property when it is allocated planning permission. There is a problem in property where a plot is given a plot number which changes through the conveyancing process to the postal address. This means that some lenders have to re-issue mortgage offers to update them with the postal address and that some documents stored at HM Land Registry refer to the Plot rather than the registered address causing confusion and, in some cases, necessitating Deeds of Variation.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We do not have sufficient expertise to provide input.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

A big issue in the conveyancing sector is the inability for systems to integrate with each other and this is the same across all of Government and industries. Basic standardisation of field names would go a long way to enabling datasets to be interoperable.

If all users of Government datasets and all Government departments and Local Authorities were required to provide an API then this could be avoided and data could flow more easily.

The development of a form of Babel fish technology which can translate one

dataset into the appropriate field names of another database would assist.

In the property transfer process much of the 18-week process is the collation of data which will be lost once the transaction is completed. By storing this data in an authenticated ledger then it could be accessed for the next transaction.

Distributed ledger technologies should be supported to establish their workability for this purpose.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

We do not have sufficient expertise to provide input.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We do not have sufficient expertise to provide input.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We do not have sufficient expertise to provide input.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We do not have sufficient expertise to provide input.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes, please see our answer to Quesitons 4 and 7

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We do not have sufficient expertise to provide input.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We do not have sufficient expertise to provide input.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Create industry and regional working groups to input into the single UK strategy and feedback to their industries and regions as the strategy develops.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Resource the Local Authorities independently for this purpose. Local Authorities are required to be the custodians of many geospatial datasets through regulation and statute and yet the requirements have not in the past come with any ring-fenced funding meaning they have had to find funding within their own budgets.

This has resulted in failure to maintain datasets, for example many Local Authorities have not had the funds available to create a register of contaminated land required by the Environment Protection Act 1990.

The creation of webforms for all applications to Local Authorities coupled with properly resourced and mandated standardisation of datafield taxonomy and the provision of an API would immediately enhance coordination whilst leaving Local Authorities free to chose their preferred system supplier and maintain competition amongst the suppliers.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

96% of home owners say that they did not receive sufficient information prior to making an offer on a property. Even during the conveyancing process, as the data is collated, it conflicts with with previous information generating additional enquiries. If Local Authority along with other public authority and private data was accessible at the point of marketing and used to populate standard and pan-industry approved datasets, we could remove much of the conflict and confusion through the process.

If a lender, and their valuer, was able to assess the available property data and open banking data they would also be able to provide a binding lending decision within a matter of minutes.

Current conveyancing transaction times are 18 weeks.

One million residential properties are transacted every year. There are another 340,000 transactions which fail. That equates to 2.68 million families in economic stasis for up to 18 weeks every year. They can't book holidays, buy sofas or arrange removals because they do not know when or if they are moving.

By freeing the barriers between geospatial data, huge economic value could be derived, not to mention the positive emotional impact of a smooth and efficient transaction.

Q18: Are there any other areas that we should look at as a priority?

Access to datasets to assist emergency services.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We do not have sufficient expertise to provide input.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We do not have sufficient expertise to provide input.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We do not have sufficient expertise to provide input.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Marine Environmental Data and Information Network (MEDIN)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**X We are a network of organisations from across the UK public and private sectors, with an interest in marine geospatial data. Our sponsors come from both the public and private sectors.**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes.
The Marine Environmental Data and Information Network (MEDIN) is an open network of UK organisations committed to increasing access to marine environmental data. For the past decade, MEDIN has been working with hundreds of organisations to make marine geospatial data openly and easily available. MEDIN currently provides access to over 220 TB of marine geospatial data via its network of specialist data centres:

UK Hydrographic Office (bathymetry data);
British Oceanographic Data Centre (water column oceanography data);
British Geological Survey (marine geology and geophysics data);
Met Office (marine meteorological data);
DASSH (marine species and habitats data);
Marine Scotland; Cefas (fisheries data);
Archaeology Data Service; Historic Environment Scotland; Royal Commission on the Ancient and Historic Monuments Wales (marine historic environment data).

MEDIN has 10 years' experience working with the three high-level themes identified above and is keen to work with the Geospatial Commission to share knowledge, avoid duplication and continue to enhance the UK's geospatial assets.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

While supporting geospatial skill training as a necessary enabling activity, MEDIN has learnt that these skills need to be developed alongside specialist knowledge of the data in question. In other words, geospatial data skills need to be taught across many disciplines, as specialised knowledge is required to interpret specialist data.

For example, an analyst of storm surge geospatial data would not be able to make use of the data to better protect UK's coastal towns and cities without in-depth knowledge of the interaction between tides, currents, waves and weather (ocean science).

With this in mind, any training developed by the commission should be modular in nature and developed in such a way that it can be easily embedded in relevant degree and other courses.

Marine science is multidisciplinary in nature and so this sort of modular approach is relatively common.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In ocean science, there can be a divergence between the tools for geospatial analysis taught by universities and those most commonly used in jobs in the commercial and public sectors. Desktop Geographic Information System (GIS) tools are commonly used for mapping terrestrial parameters and are also useful for mapping seabed features and habitats. However, these tools are not always taught in pure marine science courses as they are not generally appropriate for the marine environment, except as said above. Teaching spatial analysis skills rather than specific tools may be more beneficial in the long run.

There are unique aspects to the marine environment that require marine specific approaches. Analysing or visualising the full depth ocean environment, which, as

it is constantly changing in time, is a 4-dimensional problem. The oceans or indeed many of the species that live in them do not stay still and so do not lend themselves to being mapped in 2- or -3 dimensions. 4-dimensional tools are required for marine geospatial analysis and visualisation.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

MEDIN provides access to over 220 TB of marine data owned or managed by over 500 different organisations. For the past 10 years, MEDIN has been working with the UK marine community to increase access to marine environmental data from both the public and private sectors. Providing access to geospatial datasets is not a one off activity but is a continual process, engaging with new data collectors, encouraging the adoption of standards etc. The number of geospatial marine datasets accessible from MEDIN has grown year on year, from around 800 in 2010 to over 14,000 in 2018.

A significant portion of the public sector data accessible from MEDIN are available under the Open Government License.

Data from long established commercial sectors, such as the oil and gas industry, have traditionally been the hardest to gain open access to. However, recent changes to legislation should facilitate this. In contrast, newer commercial marine industries, such as the offshore renewable energy sector, make the majority of their marine environmental data accessible, thanks to a data clause included in The Crown Estate's tenancy agreements. Nevertheless, the cost to archive data in specialist data centres remains a barrier to making some privately-held datasets openly available.

Historically, some organisations have wanted to "hold on to" their geospatial data as they considered it commercially or academically sensitive. Within the marine sector, this is well understood and MEDIN ensures that data can be "embargoed" within its data centres until a point when it is no longer considered sensitive.

There are significant gaps in our knowledge of the global seafloor depth (bathymetry). This is a fundamental dataset with a range of applications and uses including safe trade; military and defence; understanding our planet; and for addressing the challenges associated with climate change; and has led to the establishment of the Nippon Foundation GEBCO Seabed 2030 Project. This is an

international effort with the objective of facilitating the complete mapping of the world ocean by 2030. The resultant data sets produced through this project will be available to the international community, for scientific/academic/commercial use.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The British Standard defines an address as ‘a means of referencing an object for the purposes of unique identification and location’. Noting that geospatial data can be marine as well as terrestrial, we strongly recommend that emerging technologies are developed to recognise that a “postal address” is not always appropriate for geospatial data. The UK has many structures offshore e.g. oil and gas rigs, wind turbines etc. These structures situated in marine locations do not, and should not, have postal addresses or postcodes.

Some datasets span both the terrestrial and marine environment (e.g. aerial monitoring, satellite images, intertidal surveys, etc.). Address systems (positional identification systems) need to be applicable to both land and sea. Changing address systems at the coast is not useful in these situations and can cause confusion and costly errors. Latitude and longitude, provided with the appropriate coordinate reference system are suitable for both terrestrial and marine geospatial data.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

We have learnt that a successful model for marine data is a distributed network of specialist data centres. For marine data these are currently:

UK Hydrographic Office (bathymetry data);
British Oceanographic Data Centre (water column oceanography data);
British Geological Survey (marine geology and geophysics data);
Met Office (marine meteorological data);
DASSH (marine species and habitats data);
Marine Scotland; Cefas (fisheries data);
Archaeology Data Service; Historic Environment Scotland; Royal Commission on the Ancient and Historic Monuments Wales (marine historic environment data).

MEDIN would highly recommend using specialist data centres to archive, analyse and disseminate the highly specialised Earth Observation (EO) data. The Geospatial Commission should fund these activities at a specialist data centre and then provide additional training and support to customers wanting to use EO data but are lacking the appropriate skills to do so.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

MEDIN recognises that there is a difference between a dataset and a data product. Both of these can be geospatial but the latter has some level of collation, interpolation or interpretation involved that adds value to the contributing datasets. MEDIN's focus is on providing access to marine geospatial datasets, not to producing data products.

Big data technologies that allow users to access and synthesise data from disparate but standardised sources combined with free access to the underlying data would encourage market entrants into the value-added products space.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The ever increasing volume of marine data is driving a need for “Big Data” tools, high volume storage and High Performance Computing.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We have learnt that a successful model for marine data is a distributed network of specialist data centres. For marine data these are currently:

UK Hydrographic Office (bathymetry data);
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British Geological Survey (marine geology and geophysics data);
Met Office (marine meteorological data);
DASSH (marine species and habitats data);
Marine Scotland; Cefas (fisheries data);
Archaeology Data Service; Historic Environment Scotland; Royal Commission on the Ancient and Historic Monuments Wales (marine historic environment data).

MEDIN strongly advocates that public sector data are archived at specialist data centres, that will provide long-term access to that data alongside the specialist knowledge needed to quality control, future proof and distribute that data. In general, public sector data should be made available under an open license such as the Open Government License.

In order to ensure this happens, MEDIN recommends the Geospatial Commission ensures all public sector data collection contracts include a data clause (making it mandatory to ensure data are accessible via specialist data centres). The Geospatial Commission should also ensure that the costs for managing and disseminating public geospatial data assets are included in all projects from the outset.

Public sector organizations would be aided in their public sector mission by clear separation of investment in data access from creation of value-added products.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No comment

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

MEDIN's experience of working with a cross section of the marine community has shown that a collaborative approach ensures buy in from all sectors. However, it is with the private sector that we have most problems of engagement and where further work is needed and planned.

Experience in other industries, e.g. retail energy, has demonstrated that clear delineation in the data value chain aids innovation and stimulates economic growth. The private sector is best placed to focus on value-added products built on IP and freely available data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Throughout its history, MEDIN has been developing and championing the adoption of marine data standards to improve interoperability.

MEDIN has developed a marine specific discovery metadata standard to improve interoperability of geospatial data (a marine profile of INSPIRE). In addition, MEDIN provides a suite of thematic data guidelines to ensure reusability and interoperability of marine data. MEDIN provides advice on these standards and guidelines internationally and is happy to share these experiences and tools with the Geospatial Commission.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No comment.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comment.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

We have learnt that it is not just regional variations that need to be taken into consideration when developing a single UK geospatial strategy, but we need a strategy that the marine sector can implement in a marine-specific context.

MEDIN developed a single UK strategy for marine geospatial data for the Marine Science Coordination Committee and is happy to share this experience with the Geospatial Commission.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No comment.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Coastal defence of UK infrastructure.
Sustainable use of ocean resources.

Q18: Are there any other areas that we should look at as a priority?

Defence and mitigation from environmental hazards such as:

- storm surges and coastal flooding
- sea level rise
- seafood security in a changing climate
- predicting extreme events

To put the first of these into context, coastal flooding is rated as the second highest risk of civil emergency in the UK, after pandemic influenza (National Risk Registry of Civil Emergencies, 2017). Consequences of coastal flooding can include fatalities and casualties; widespread damage to property and infrastructure; disruption to essential services, particularly transport and energy; environmental damage and contamination.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comment.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Membership and ultimately chair of relevant committees. Strive to ensure a two-way flow of information. MEDIN is already well connected to EU and other relevant international geospatial organisations.

Use success stories such as MEDIN as examples of how UK is at the vanguard of best practise.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

MEDIN, INSPIRE, OGC.

Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Met Office
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Seems a sensible definition for static data in point 2. However we deal with a lot of live data. Both raster and point data. This is growing rapidly in importance. The Met Office has been doing a lot at the OGC in defining how it should be formed. This yet to come into the traditional GI space. Generally lacking is guidance on a standard way to manage such data to allow re-use and tie into a particular format. This needs to be added.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There is a tendency within IT based organisations such as the Met Office to adopt a slice of Geospatial technology that fits the current technology fashion an extension of the programmers existing knowledge. It is often not re-usable and uses formats that come and go. There is a lack of understanding of the whole geo-spatial “space” is delaying the sharing of capability. We need to reduce the barriers to entry at every level

Training

- Senior managers/leaders need to understand the value of GI teams make to an organisation. In terms of capability and outreach.
- At least one System Architect in an organisation should understand what’s happening in commercial GIS in any organisation.
- More incentives for GIS Apprentices
- Non degree level qulifications to go along side Apprenticeships NVQ? Reduce the barriers to entry
- In schools add it to curriculums beyond Geography bring into Science,Mathematics,History,RE. Similiarly in higher levels of education.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We need to bring skills together questions like do we do geospatial in the database or in the client? These are never answered. We need multi disciplined teams with strong GI lead.What form the data should be and the software capability is done in terms of expediency to do a particular project. No long term vision. Any system such as a GIS that will fullfill a range of needs can be easily ignored to get to the immediate goal.

We need people capable of understanding the whole picture. GI teams in many organisations are often too small and beleaguered.

So we need :

- Mult-displine teams of GIS, programmers and database experts thrown together
- A recognition of the value of people who take the time to understand the wider GI domain. Can we have a career beyond GIS Analyst?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

Ordnance Survey NI why is different from Ordnance Survey? Can't they use the same resolutions, same raster mapping style? Why can't I get hold of OSNI in the PSMA? Similiarly why is SEPA data different resolutions from EA data? Can't we be UK? Can't it be a web service? This would save so much work.

Each organisation is collating data from the OS in little files. Can't it be supplied as a mosaic ready to load. No more GML which needs translating. A web service may help with this.Again individual organisational effort.

Now a critism of my own organisation. Why can't anyone just access via a web service/download Met Office data and use it in a GIS without translation. Also discover it easily. It doesn't have to be everything just the most useful. This again would enable many users who are not programmers. Save effort and consultancy.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We need NI data in the PSMA..

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Easily accessable live feeds of satellite ground imagery, weather, tidal and flood to support major incidents / disaster responses.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- **Centralised discovery of ready to consume GI data. Discovery portal bringing together existing sources.**
-
- **Build it as one source of truth for UK data**
- **Standardised real time methodologies so data streams can readily be consumed by basic GIS tools and instructions**

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Easy to find, ready to use data well defined data from the point of truth organisation will be an enabler. It must be quick otherwise users will find something else to consume right or wrong.

Applications that allow youu to discover, check against other data again will enable.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

GIS able young people were the first to go from my organisation when pay tightened and the specture of reduncies loomed. They have the ability to change jobs however were the life blood of a better future. There is less time to advocate and explore new ways of doing things. We need to ensure public organisations have the mandate to:

- Maintain core GIS capabilities
- Have a senior role to push through time saving capabilities across the organisation and engage with other organisations.
- Organisations should be given a mandatory requirement to provide GI data in an easy to consume form. 3 Clicks! Discover,Check,Consume!
- Mandate organisations must retain GI capability
- As resources are short facilitate GI people from other organisations to blitz start new GI projects to share data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

N/A

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

They have the reach and understanding of a group of sectors that exceeds a Government Department. They can encourage and facilitate the sharing of geospatial information and demonstrate the benefits.

They can adopt the common stanadards fully or if they can't improve them to ensure interoperability.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Finding it is the major headache then finding you cannot use it or a bits missing. A central search engine using OGC and commercial standards (e.g. WCS,WMS,WFS, REST services). API's that allow standard data forms tif,shape,netcdf

Common standards to real time data. Even a simple one would be better than non at all.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Push the PSMA to cover the whole UK and provide web services

Provide examples of good practice with the minimum you can get away with!

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- OSNI datasets.
- Met Office UK Climate data. Met Office Observations in a form that goes straight into a GIS. Soil Moisture calculations. Some Forecast elements.

You discover by keywords, check whether data is fit for purpose and you pull it in.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

A UK National Strategy would be welcome.

- Make it a minimum standard. Inspire was a nightmare also GML
- Allow national level purchasing of complient software “bulk buy”

But it must be kept up to date with annual reviews and keep up with new standards and technologies. Must be on going or it will die.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Bit out of my remit

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We would add “protection of life”.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Get the data up there in an easy to consume form

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We often look to the US https://www.fgdc.gov/nsdi-plan/nsdi-strategic-plan-2014-2016-FINAL.pdf

Perhaps we can learn from them.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

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Organisation	Met Office
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Big data mash-up tools, open source code and individuals trained (or possibly a dedicated team to support others) in analyses of large geospatial data – to enable quick and efficient analyses of large geospatial (and non-geospatial) datasets with diverse formats, projections etc.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

More integration of GIS data (shapefiles) and applications with data and models used with meteorological observations and modelling (typically using python or FORTRAN code).
One way to address this is through common data formats, possibly via simple data conversion applications or through conversion of a few key meteorological indicators into GIS format for use with GIS applications (lots of questions to address if doing this).
Careers in this could be promoted through well-funded projects including PhD studentships that involve use of such differing data across organisations.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

No one dataset in particular, but in general very large geospatial datasets i.e. global and/or high resolution and/or multi-layer, and/or with differing characteristics such as projection, resolution…

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Human health – more personalised and patient participant health outcomes

Plant and Animal Health – more potential observations of high risk pests/pathogen

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Enabling simple data mash-ups – comparing high-resolution satellite data and ground-based observations

Research to understand relationships between EO data and ecosystem processes e.g. carbon uptake, crop productivity…

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Drone observations – to provide bridge between wider EO data and ground/point observations
…in order to support understanding of the relationships between EO data and ecosystem processes and scaling up/down of processes.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Early warning systems - Continuous monitoring of surface changes e.g. coastal erosion, crop productivity…that can be used with new technologies of ground-base monitoring e.g. plant and animal health, coastal erosion…, to help target rapid on-the-ground actions.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Research and modelling of the relationships between EO data and ground observations and processes.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Don’t know

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

Near surface (i.e. drone, aeroplane) and ground based sensor development for range of sectors and observations, e.g. personalised health monitoring, plant productivity for agriculture…

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes, challenges associated with:

- IPR – some geospatial data are restricted
- Processing large datasets – computing resource and programming capability to analyse large geospatial datasets
- Combining raster and vector datasets e.g. we use many (raster) gridded observations and model data which are not always easy to compare with vector data such as shapefiles

Evidence of remedy:

- Developments with (open source) python/IRIS programming have helped with data format conversion and analyses of EO gridded data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission could support development of a standard set of software tools and/or code available in open source language e.g. python, python/IRIS, and on a code repository e.g GitHub, GitLab (developers working together) for reading in and simple analyses of a wide range of geospatial datasets.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Bluesky tree mapping
Met Office WOW (Weather on Web) citizen science weather observation network
Met Office pollen monitoring network

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Rather than enforcing/encouraging use of same data formats or selecting specific datasets for interoperability, it would be more flexible to provide tools/code for enabling comparison between the different data formats…this way more data of wider formats etc can be included and the overhead would be to add new code/tools for reading this data and enabling it to be compared with other geospatial data.
Also, provide 'recipes' for comparing datasets e.g. regridding guidance and steps to take, or even code to do these steps.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Start by asking local authorities what they need to improve most using geospatial data, then help them to do this…where possible apply this to other authorities if they also need such improvements.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Personal health monitoring – fitness and general health monitoring, linking with GP guidance and alerts, public health warning targeted to most vulnerable persons…

Farming and other ecosystem management – linked with weather and climate monitoring, soil moisture and condition monitoring, pests and disease monitoring and surveillance, fire monitoring…

Q18: Are there any other areas that we should look at as a priority?

Human health

Plant and Animal Health including new and emerging pests/pathogen (if not covered already under Natural Resources)

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Computer code/tools for enabling easy comparison of geospatial datasets.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Enabling public access to publically appealing (e.g. bird migration and weather data/systems together) geospatial data on platforms such as google earth.

Providing web tools that give early warning info for farmers and other weather/climate, or air/water pollution sensitive sectors…linked with forecasts.

Provide regular updated data/indicators from the UK CCRA (Climate Change Risk Assessment) on easy to use web tool e.g google earth like.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

ESA Climate Change Indicators CCI's

USDA Drought monitor for farmers in US

EEA Environmental Indicators

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Met Office
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X (Executive Agency of BEIS)**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

When developing a National Geospatial Strategy, it is important to base it on a clear understanding of not only different data types (which the Call for Evidence notes) but also the distinction between data, information and for example predictions – which present different challenges to static data – and it may be helpful for the Geospatial Commission to consider greater clarity of its focus in this regard.

For example in the Met Office we use meteorological observation data to initialise our physical weather and climate model, which drives our forecasts and services: both of which are information, based on predictions rather than data. So with these distinctions we would not tend to describe such geospatial services as a data type.

Similarly, the word 'services' in the naming of the fourth data type "Geospatial Services" could create confusion. Perhaps geospatial insights or geospatial products would better describe this class of data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

As a science and technology organisation, and working regularly with geospatial organisations including the Partner Bodies, we support action to build geospatial skills and capabilities for the future, including in areas such as GIS, data science and data analytics and importantly for this skills development to take place right across the UK.

With regard to producing graduates with appropriate geospatial skills, it may be worth considering whether valuable core skills are covered appropriately across a range of relevant courses. For example as a large employer of maths, physical sciences and geography graduates we have seen that there can be inconsistency in the level of digital and programming skills which are taught as part of undergraduate degree courses with the result that we have had to provide additional training in these core skills to fill the gaps. These skills are increasingly vital to tackling geospatial problems, so consideration of ways to ensure a baseline standard across courses would be beneficial both to students and employers.

Employers can have an important role to play in ensuring graduates (at all levels) have appropriate skills by working closely with education providers in the development of courses or initiatives. For example the Met Office is supporting skills development through initiatives such as the Data Science Institute at the University of Exeter, with joint academic appointments and projects, as well as supporting the proposed South West Institute of Technology. The Met Office is also supporting a number of national bids for doctoral training programmes on data science for UKRI (NERC and EPSRC).

With regard to career prospects and attracting students to the relevant disciplines, there could be benefit from doing more to show how geospatial skills can underpin a variety of roles across many organisations and industries, reflecting the practical need for blended skills and the application of specialised skills to a range of areas.

It is also important to recognise that the academic route is not the only way to develop skills and we have found significant value in offering alternative career and skills development pathways through the introduction of apprenticeships and trainee programmes.

An important aspect of geospatial skills development to also recognise the value which comes from having a breadth of knowledge and encourage students or staff to develop that. Extracting value from Geospatial data and technology can be achieved in a variety of ways including combining information from a variety of sources and disciplines to generate new insight. Ideal geospatial skills will be underpinned by Mathematics, supported by domain knowledge of the data sets being aligned, compared or analysed. In technological and scientific career paths, a *depth* of understanding is often more valued than a *breadth* of knowledge; such as a combining applied science, statistics and technology. This is a systematic issue that could be addressed by creating a culture that rewards multiple domain experience.

Finally, it is widely recognised but important still to note – and take action on the fact – that to increase skills in Science, Technology Engineering and Mathematics

(STEM) areas it is vital to engage children at early stages of their education and build a connection with these subjects. The Met Office works with young people across the country to build interest in STEM careers for example. This is done through our wide-ranging programme of outreach which aims to engage young people in Met Office science and technology (and STEM more generally), encourage interest in STEM careers, raise awareness of the varied work of the Met Office and to share our science. Similar programmes could be used to engage young people in other geospatial skills, through highlighting the varied careers that development of such skills can offer.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The Met Office, in common with many other employers, is finding it increasingly challenging to recruit data science and analysis skills – particularly those at the mid-career and senior levels where technical understanding is combined with broader experience and management skills. This is due to a combination of factors including increased demand for these skills across the economy; the challenges of recruiting outside of London and the South East (even when we are located within an emerging cluster of excellence); and the challenges of public organisations competing with private sector pay levels, particularly at senior levels.

There are some positive developments – suitable courses are starting to emerge as colleges and universities, including those in Exeter and the South West, recognise the demand. The Met Office is encouraging this through its support for the proposed South West Institute of Technology led by Exeter University and involving other Universities, 6th form colleges and Higher Education institutions in the region. This will join up existing activities as part of a more ambitious objective to develop a skills escalator for technical skills in the region from 6th form through to degree level and improved employment and business development in the region. We are also encouraged to see high profile investments such as the Turing Institute which are starting to address the skills issue at the top levels of research and doctoral training.

Additionally, as part of the Government Science and Engineering network, we support the development of the Geography profession within the GSE network which includes a focus on geospatial skills. This new profession intends to offer staff networking opportunities across government and learning and development opportunities. In addition, networks such as the Government Geography profession could also facilitate secondments across like-minded organisations to allow staff to develop their skills and apply them to a range of problems throughout their career.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The Met Office and our customers are increasingly interested in data which can help us to understand risk, of which the hazard is only one component. We have good access to geospatial hazard data for weather and climate hazards, however the data covering exposure and vulnerability can prove more difficult for us to access. The specific Geospatial datasets which we need depend on the question being asked, however they often relate to infrastructure (such as the location of key assets), population data or land use.

We have found that poor curation of data significantly impedes its use, particularly when that use is for purposes other than that for which the data were originally collected, especially where GDPR requirements may come in to play. This was also noted in the Treasury discussion paper on *The Economic Value of Data* (link) which highlighted that the potential value of data may not always be foreseeable to the data creator or controller. Data about risk exposure or vulnerability is often collected with little or no geospatial data, which limits the extent to which it can be reused to generate additional benefit. Encouraging the inclusion of geospatial data and high quality metadata in more datasets would help to unlock additional synergies and generate new information and services.

For example the Met Office are currently working with Highways England to compare road data with meteorological data to better understand how weather and climate impacts road conditions; however poor quality location data in the road sensor dataset has created additional work to go back and properly characterise this data. Similar issues have been experienced when working with rail and electricity network fault data. We would therefore strongly support actions to raise the general awareness about what “good” datasets look like, and efforts to meet a minimum standard to ensure reusability. This would enable the UK to get better value from the investment that goes into collecting data, and the public sector could lead by example on this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The Met Office don’t tend to use addressing data in this way. Meteorology isn’t just land based or even UK based and our interest is through the depth of the atmosphere and oceans, so our reference systems are based on latitude, longitude and vertical height.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Met Office is a long-term user of space-based Earth Observations (EO) for meteorology and as such is an expert in the exploitation of this type of data. In meteorology and climate science, Earth Observations are considered to include both satellite observations and in-situ measurements; however, we have seen the term used to refer exclusively to space-based observations without this being specified which can cause confusion. We have provided some more information about our experience in working with satellite EO below.

The current capability in EO has been developed through long-term international collaboration as it is difficult for any single nation to provide both the broad range of skills and the high level of funding required. This model works well as there is a common base requirement both across Europe and internationally. Continuing engagement with the international community will be vital to maintaining and developing the UK's EO capability.

At present the UK's use of EO data and engagement with EO data providers is led by expert users, often in a narrow context related to their specific requirements. More value could be unlocked from this data by building on the good work already done and creating a common access model for Government and non-government stakeholders. Such an access model should have inter-departmental sharing of data for the public good at its heart, and work in collaboration with existing users to ensure that current access and expertise is not diminished.

Importantly, in creating an 'effective market', a balance needs to be found which encourages the free sharing of data without diminishing its financial value. While the private sector can provide innovative and effective approaches to EO data; partnerships between the public and private sector need to ensure that contracts do not prevent the re-sharing of data between public bodies for safety critical services and the public good. Best practice in data standards and licencing can be used to ensure that the value of such data is maximised.

The provision of data as a service must be affordable to users, which will require careful consideration of the business models used. Such data services need to provide data of a consistent quality; with robust, traceable and transparent information on the data – including about data collection, creation or processing – being available to ensure this. Our work in using EO to understand climate change, has highlighted the need for such metadata to provide a consistent record in order to maintain the quality of our climate records. We would be happy to discuss these challenges further with the Commission if this would be helpful.

In the Met Office we have found that assimilating basic data (such as satellite radiances) directly in our Numerical Weather Prediction model is an efficient way of establishing the atmospheric state as a starting point for predicting its future development and leads to improved forecast products. So we tend to work with this basic data rather than processed data (such as atmospheric temperature profiles). This approach also provides us with more control over the data

processing, so we know about any changes to the data immediately and can react accordingly. Provision of data from novel EO suppliers should build on this expertise, and include partnership working to maximise the value extracted from their EO data.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

When considering the use of new technologies consideration should be given to the interoperability of various technological platforms, through the use of tried and tested platforms and standards such as those developed by the Open Geospatial Consortium (OGC).

While new technology will undoubtedly unlock further innovation, there are still significant benefits to be unlocked by making existing proven technology work for all and this opportunity shouldn't be missed by focussing just on new technologies.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Autonomous vehicles are one future technology with a significant requirement for geospatial data and we outline some examples of how such data can be used to support the roll out of this technology below. Similar considerations are likely to apply when considering the geospatial data requirements of other future technologies.

Autonomous vehicles will likely require a diverse range of data and information, which may be rapidly changing over hours or even minutes (such as meteorological observations and predictions) in order to deliver maximum benefits. Agreed standards of data interoperability will help to ensure that data can be exploited by a range of users, thus maximising the benefits of such data.

The information available to such vehicles will likely be coming from a range of sources and for example could include near real-time observations of hazards from other vehicles, and predictions of potential risk; the limitations of such data and information (e.g. how long ago hazardous conditions were reported, or the confidence of a prediction) should be considered and included in the decision-making systems which use them.

Use of interoperable data standards would also enable the reuse of data from

such vehicles for other purposed. For example the Met Office use MODE-S data from aircraft to provide us with additional atmospheric temperature and wind measurements, and similar data from other vehicles could provide valuable information; for example about urban meteorology and air quality.

The data infrastructure that is required to support the autonomous vehicle network will need to be capable of assimilating and processing vast amounts of data within seconds (or less) to enable all vehicles to rapidly respond to changing environmental conditions. As such, investment and innovation in transmission, processing and the quality of the data itself may also be required. In order to manage the data volumes required by future technologies such as autonomous vehicles there is also a need to have 'intelligent customers', and dialogue with data providers, so that requirements and limitations can be understood. This will allow the most relevant data to be shared with the right users at the right time, maximising the use of available data transmission and on-board processing capabilities.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The Met Office agrees with the points made by the National Geospatial Commission about the need for business models which maximise the opportunity for users to gain value from the data, while also supporting the sustainable and up-to-date development of their geospatial assets.

We also agree that investment decisions need to consider more than just the data assets, but also the infrastructure that supports it.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Enabling users to gain value from the data requires the data to be useful and useable. To that end, data accessibility through consistent data formats, data catalogues, data licensing etc. are key aspects of the infrastructure. This aligns with the INSPIRE directive (as referenced in the Geospatial Strategy document) which establishes an infrastructure for spatial information in the EU to make spatial datasets available in a consistent format.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

When working to support the public sector, the private sector should be encouraged to use ways of working which are compatible with data sharing and reuse for the public good. For example, updating public procurement requirements to encourage Government suppliers to adopt the use of open data standards or include agreements regarding the release of data for known and agreed purposes.

Care should be taken to understand the available private and public sector data capabilities; and avoid unnecessary duplication of capability development. The robustness of data driven decision-making tools should also be available for challenge, with a transparent approach to methodologies allowing customers to understand how decisions are being made. This approach can also enable innovation though better understanding of both customer requirements and supplier capabilities.

Maintaining geospatial data expertise in the public sector is a vital part of being an intelligent customer when developing partnerships with the private sector. The public sector will need to maintain an expert understanding of its data and the requirements for storing, moving and processing it in order to develop the most appropriate solutions for the development and maintenance of this data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The Met Office has a remit to provide services to support decision-making, however there are valuable opportunities to be unlocked from combining meteorological observation data and forecast outputs with other data (from both the public and private sector). There are currently significant challenges to overcome in order to combine sources of data with a myriad of data standards, formats and legal statuses due to their origins in different organisations.

Appropriate and clear licencing of geospatial data is vital when making it available to others. Ensuring that public sector datasets have a clear licence, ideally tending towards open access and making use of existing open data standard licences would make it much easier to understand how public sector data can be reused by other public and private sector organisations.

For example the Met Office have been working with other public sector organisations to understand the possible scale of socio-economic benefits associated with enhancements to the rainfall observing networks (typically from radar and rain gauges), specifically in the context of flood mitigation. This work required access to information concerning river catchment boundaries, time to peak river flows and properties at risk in terms of flood return periods. While all required data were in existence, there was significant inefficiency in terms of access and common standards across the datasets, which could have been reduced with improved data standards and licencing.

The Met Office is part of the World Wide Web Consortium (W3C) and involved in the development its Data on the Web Best Practices. Increasing public sector engagement with such consortia would help to improve the visibility of public sector data, and help public sector organisations develop consistent standards that complement their ways of working. In addition to using international best practice for data on the web and licencing, using international standards for data quality and interoperability will also help with the sharing and reuse of public sector data. The Met Office is part of the Open Geospatial Consortium which is trying to develop standards, tools and best practices to simplify the sharing and use of geospatial data.

We have previously led initiatives with other public sector organisations to improve data access and interoperability, such as the Environmental Science to Services Partnership's DataSpring prototype which provided a single sign-on one stop shop for trusted environmental data. Members of the geospatial Commission were involved in this work and are taking the learning forward in the work they are doing on common licensing, intellectual property and access.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

More could be done to clarify how different government data strategies and initiatives work together across the existing landscape: including local, devolved and national government, and work done in different departments. This would enable stakeholders within and beyond government to better support the UK's Geospatial aspirations.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Meteorology has a role to play in supporting core geospatial organisations in all of these areas, particularly mobility, natural resources and sales and marketing; and the Met Office is currently working to support these sectors through a variety of geospatial services. The dynamic nature of weather predictions (which are updated every hour) mean that they need to be treated differently from the underlying geospatial data. However, when dynamically combined with other sources of dynamic or static data, e.g. from transport systems or utility infrastructure networks, they can add significant value.

Met Office work on understanding and mitigating future weather and climate risk around infrastructure and construction is currently being done in a piecemeal way, on a case by case basis, with poor data for the reasons outlined in our response to question 4. More benefits could be generated by developing a more coherent approach: through the collation of good quality infrastructure impact data from a range of sources.

Q18: Are there any other areas that we should look at as a priority?

Following on from the National Flood Resilience Review (NFRR), more could be done to understand the risk to critical national infrastructure from flooding. Plausible extreme rainfall data from the Met Office was made available through a Government Non-commercial licence for a Defra competition (more information is available here: https://consult.defra.gov.uk/water-and-flood-risk-management/flood-risk-management-modelling-competition/). More value could be unlocked from this data by combining it with data about the location of infrastructure such as mobile phone masts and electricity sub stations, to continue the work on local resilience outlined in the NFRR.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

As stated in response to question 8, autonomous vehicles are one future technology with a significant requirement for geospatial data, we have outlined some of the regulatory geospatial data challenges which may arise in this area, many of which will also be applicable to other areas.

The connectivity between physical infrastructure and moving vehicles is likely to be affected by aspects such as weather conditions and topography. This effect is already being seen in testing of 5G connectivity and innovation in this area may need to be adopted to build scalable and reliable transport solutions in the UK.

The current generation of autonomous road vehicles rely upon lidar, radar and camera type sensors for various aspects of their operation. It is our experience that all can suffer either degraded performance, or even misleading output, in specific severe weather conditions. Indeed severe weather issues are often cited as one of the key obstacles in the development and adoption of autonomous vehicles. Collection of high quality metadata from such sensors could help to characterise their performance in a range of conditions, and allow variation in sensor performance to be taken into account by decision-making systems. With this in mind, consideration should be given to how regulations consider the performance of critical sensors and systems (including data transmission systems) and their ability to deliver data of sufficient quality under varying weather conditions.

Similarly, it is assumed that autonomous road vehicles will have a reliance on global satellite navigation systems such as GPS. From our position as the UK's Space Weather Operations Centre and space weather risk owner, we think it important to note the risk posed to these systems by space weather events. During a reasonable worst case event, GPS data may be degraded or completely lost for 1-3 days. There are also parts of the globe where GPS signals are interrupted on a daily basis due to space weather activity. It is not possible to improve upon the GPS technology to mitigate this risk as it is changes to the atmosphere which cause the degradation. However, governance and guidance of

use during space weather events, including the requirement for back-up systems which are not reliant on the same technology and are not susceptible to space weather, should be considered.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The Met Office have seen significant benefits from engaging in international data standards consortia such as the Open Geospatial Consortium (OGC) and World Wide Web Consortium (W3C). These allow us to contribute to the development of standards, tools and best practices which complement our ways of working; and enable the sharing of expertise from others in the international community. There are benefits to having multiple UK organisations operating in these consortia, as different public sector organisations have different concerns and priorities, and multiple UK organisations can amplify the UK's influence on issues where these organisations are aligned.

The Met Office also represents the UK in the UN's World Meteorological Organization (WMO), which sets international data standards for meteorology and hydrology, including agreements on the sharing of data between national meteorological services. Other UN organisations provide similar functions in other sectors, such as the International Oceanographic Commission (under UNESCO) and the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM). The WMO has a Memorandum of Understanding with the OGC and is beginning to endorse OGC standards as part of their international regulatory framework, so we are continuing our involvement with these organisations so that we can be part of the development of data standards and best practice. Active engagement with international bodies such as the WMO can help to raise the UK's profile on the international stage.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Pangeo (USA and international)

The Met Office has been working in collaboration with Pangeo (http://pangeo.io/), the aim of which is to cultivate an ecosystem in which the next generation of open-source analysis tools for ocean, atmosphere and climate science can be developed, distributed, and sustained. These tools must be scalable in order to meet the current and future challenges of big data, and these solutions should leverage the existing expertise outside of the geoscience community. Rather than designing and creating a single monolithic application, Pangeo's vision is an ecosystem of tools that can be used together, by fostering collaboration around the open source scientific python ecosystem for environmental science. Amongst

other things this technology will support the development with domain-specific geoscience packages; and allow users to bring their problems to the data.

Copernicus (EU)

The EU's Copernicus programme produces very large data volumes (currently 12 Terabytes a day), which are being used by a wide range of stakeholders. To facilitate and standardise access to this data, the European Commission is funding the deployment of five cloud-based platforms providing centralised access to Copernicus data and information, as well as to processing tools. These platforms are known as the DIAS, or Data and Information Access Services. There are 5 parts to this initiative, being led by various Copernicus partners.

Geonovum (Netherlands)

Geonovum is funded by various Dutch government departments with geospatial interests, and has strong links with the private sector and academic research, such as a Technical University of Delft. The Netherlands have a balance between private sector making a profit, using open software, publicly funded infrastructure, academic research, and are not scared to take a lead in innovative issues that carry some risk, but potentially great benefit such as "Smart Cities". They are also active on the international standards front: the Co-Chair on the W3C Spatial Data on the Web Interest Group is Dutch; and they are involved in the OGC Architecture Board, providing expertise on IT security applied to geospatial.

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	MINI MAP-MAKERS
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	X
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

YES - ALL GOOD BUT ITS THE TRUST ELEMENT OF THE DATA - HOW DO WE KNOW AS USERS ITS CORRECT? HOW DO YOU KNOW ITS CORRECT?

ONE CENTRAL PORTAL FOR THE DATA - MAKING SURE ITS UPDATED AND NOT REMANED EVERY OTHER MONTH - LIKE THE OLD OGA!!

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I WORK WITH CHILDREN JUST STARTING SCHOOL - 4 YEAR OLDS WHO ARE LEARNING TO LOOK AT SHAPES, COLOURS, LETTER AND NUMBERS
THESE ARE BASICALLY WHAT MAPS ARE
SO SUPPORTING FROM THE GRASS ROOTS LEVEL WOULD BE AMAZING!
MAKING SURE I AM IN LINE WITH THE PATH THAT EVENTUALLY LEADS TO A JOB..

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

I AM A PROFESSIONAL CARTOGRAPHER, GIS USER AND GEOGRAPHER

I GO INTO ALOT OF SCHOOLS- ALL AGES AND THEY DONT KNOW HOW TO MAP READ.
DO THE BASICS FIRST
ALOT OF SCHOOLS DO NOT HAVE COMPUTERS - IF THEY DO - GREAT BUT THERE IS NO INTERNET TO SUPPORT 30 STUDENTS ACCESSING THE SOFTWARE/INTERNET!
I AM TALKING TO ESRI ABOUT THIS!

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

UPTO DATE HOUSE PRICES, EDUCATION NUMBERS, ENVIRONMENTAL NUMBERS/DATA, I USE ALOT OF DIFFERENT DATA TYPES - FROM ALOT OF DIFFERENT SOURCES!
SO TO REMEBER TO UPDATE EVERY MONTH - I GOT TO AT LEAST 20 SITES!

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

DATA AND THE SOFTWARE NEEDS TO KEEP UP - THERE WILL BE A MORE NEED FOR AR AND AI AND ALL THE INFRASTRUCTURE THAT GOES WITH IT!
GO TO A GEO BUSINESS OR GEO DATA OR ESRI CONFERENCE AND YOU WILL SEE THE HUGE ADVANCE IN TECH
NOT ALL MICRO COMPANIES CAN CATCH UP / KEEP UP OR FINANCIALLY KEEP UP AND BE COMPETITIVE!

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

KEEP WITH EUROPE - DON'T REINVENT THE WHEEL - IT WOULD PUT US BEHIND AGAIN
[Text redacted]
THE OBS DATA NEEDS TO BE SHARED NOT RE MADE

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

GEO FRAMEWORK OF DEVICES - MAKE SURE ALL THE DATA WE HAVE IS ACCURATE
AN AUDIT OF WHAT WE HAVE
WHAT DONT WE HAVE - THIS WILL THROW UP QUESTIONS ABOUT HOW WE GET THAT DATA
INFRASTRUCTURE
SECURE LOCCATIONS FOR STORAGE

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

ONCE THE DATA AND TECHNOLOGIES AUDIT IS COMPLETED
OTHER QUESTIONS CAN BE ASKED AND SEE IF THEY FIT
THE FRAMEWORK - IF THEY DONT
THERES YOUR ANSWER
I THINK SCHOOLS SHOULD BE A STARTING POINT
THEY ARE SIMPLY NOT LEARNING THIS GIS OR GEOSPATIAL
STUFF AS THERES NO INFRASTRUCTURE! AND THE
TEACHERS NEED TO EMBRACE IT TOO.PROPER
SUPPORTED TRAINING FOR THEM - NOT A 2 DAY COURSE
AND OFF YOU GO.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

THERE NEED S TO BE A PROPOER AUDITED PORTAL FOR THEIR MOST UPTO DATE INFORMATION
ACCESSABLE TO PUBLIC
SOME DATA WILL NEED TO BE AUTHORISED
AGAIN A PROPER FRAMEWORKS ORGANISATION OF WHAT IS THERE NOW

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

WE ARE OK FOR THE OUT DOOR - DUE TO THE SATELLITES
I THINK THE INDOOR WOULD BE THE GREAT PLACE TO START
PUBLIC BUILDINGS- HOSPITALS, STATIONS
THIS WILL THROW UP QUESTIONS AND ISSUES THAT WILL BECOME A STANDARD FOR OTHER SITES.
THE BEST GPS FRAMEWORK
ASK THE YOPUNGER GENERATION WHAT THEY WANT TOO - AS THEY WILL BE MAKING/DEVELOPING /USING IT ULTIMATELY

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

DATA CONTRIBUTION
FRAMEWORK AND POLICY HELP AND SUPPORT
APPRENTICESHIPS
FUNDING TECH/TEACHING IN SCHOOLS - PROFESSIONALS INTO SCHOOLS PROGRAMME
MAKE IT PART OF JOB DESCRIPTIONS TO HELP IN LOCAL SCHOOLS AND SUPPORT TEACHERS

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

I JUST GET FRUSTRATED OF THE AGE OF IT AND ALSO IT IS COMPLETE AND ACCURATE
HOW CAN I CHECK IF THE NUMBERS/ NAMES ARE CORRECT?
I JUST HAVE TO USE IT AS IS. I AM A ONE PERSON BUSINESS SO RELY ON THE DATA BEING ACCURATE/COMPLETE
THATS WHY IF THERE WAS ONE GEOPORTAL - WHERE THEY UPLOADED THEIR MOST UPTODATE DATA FOR THE PUBLIC TO USE..
LIKE THE OIL COMPANIES WITH THE OGA - THAT WORKED REALLY WELL- I USED TO HAVE TO DO THIS! SO I MADE SURE THE DATA WAS A OK AND UPTO STANDARDS

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

GETTING A LIBRARY OF ALL DATA AVAILABLE IN ONE PLACE - NOT NECESSARILY THE ACTUAL DATA
BUT WHAT IS AVAILABLE IN THE UK/GB
WORKING WITH THE SCOTTISH/NI AND WALES GOVERNMENTS ON COLLABORATION OF IDEAS
TIMETABLED UPDATES FOR DATA
MAKE IT A STANDARD THAT COMPANIES CAN ADHERE TO LIKE AN ISO4001

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

YOU WOULD HAVE TO BREAK THE DATA UP INTO THEMES
BASEMAP
ENVIRONMENT
SOCIAL
ECONOMIC
ETC

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

MAKE IT POLICY THAT THE LAS PUT THEIR DATA IN A PORTAL THAT IS UPDATED MONTHLY - THERE ARE GIS PEOPLE THAT ARE DOING THIS NOW - MAKE IT PART OF THEIR JOB AND DEPARTMENT - THERE HAS TO BE A STANDARDS LEVEL TOO - 5 STAR ETC..
EG - PLANNING INFO IS LEGAL SO THATS UPTO DATE! OR IS IT..?

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

TALK TO VERISK/GEOINFORMATION - THIS HAS BEEN DONE ALREADY BUT PEOPLE HAVE TO PAY FOR IT..
DONT WASTE TIME REINVENTING ANOTHER HOUSING LAYER..THEY WILL NEED TO PROVIDE X AMOUNT OF DATA TO YOU - OTHER DATA NEEDS TO BE PURCHASED.
INFRASTRUCTURE & CONSTRUCTION - AGAIN THE COMPANIES NEED TO GIVE YOU THE DATA AND PUT A VALUE ON THE REST.
ARE YOU HERE TO MAKE MONEY, ADVISE OR GIVE OUT FREE DATA ?

Q17: Are there any other areas that we should look at as a priority?

ENVIRONMENT
EDUCATION
HEALTH
SOCIAL

(IN NO PARTICULAR ORDER)

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

TALK TO THE OU IN MILTON KEYNES..
I CANT ANSWER THIS ONE!

Q19: How best can we make the UK's presence in the international geospatial world more visible?

HAVING A CLEAR CONCISE FRAMEWORK
HAVE LEGITIMATE DATA
HAVE SECURE DATA
HAVE CONCISE AND ACCURATE TIMELY DATA
HAVE A COMPLETE CATALOGUE
HAVE THE FASTEST ACCESS AND GREAT SOFTWARE AND CARTOGRAPHERS / GRAPHIC DESIGNERS TO VISUALISE THE DATA
HAVE A EXCEPTIONAL EDUCATION PROGRAMME TO ENSURE LONGEVITY

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

ANY OIL COMPANIES
NPD IN NORWAY
GEOSCIENCE AUSTRALIA
https://opendata.swiss/en/

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	MRS Census and Geodemographics Group
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X – Market Research Society**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The items listed make sense, but it is our view that Geospatial is more than landscape and built structures and extends to population, society and the geography of consumer behaviour.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Skills training and careers could be promoted via recognised industry bodies.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Open National Address File (with geospatial element)
A standard, universally recognised address list available as an open dataset would be very benenficial, particularly if supported by accurate geospatial referencing. The value of this would extend across many areas from understanding consumer movement, transport planning, resource planning, and linking these to the private sector without barriers to entry caused by different address definitions or the cost barrier of licensing.

Lookup between PAF UDPRN and UPRN
If this were available as open data it would greatly assist in supporting our public sector clients and also enable us to exploit the value of an open UPRN with co-ordinates dataset

Land Registry INSPIRE property polygons
Royalties for commercial use make this challenging to use.

Public Transport timetable data
This is currently only available in a very complex form and is very time consuming to extract and exploit. We also have issues with data quality.

Workplace population
Regularly updated estimates of worker population at a low geographic level (e.g. workplace zone) would be of a lot of value in understanding the changing demands for services in an area. Currently we only have census data from 2011, which by the time the next census is released will be at least 12 years old. The LSOA estimates from BRES are too high level and we believe not always that reliable/plausible for local analysis being based only on the BRES survey. Could the IDBR be used for this sort of application?

DVLA licence plate to postcode/OA file
For understanding shopper catchments & demographics – almost all our clients have ANPR and capture licence plates (including local councils). If you were able to code them with a geodemographic classification and map them at a non-PII level eg OA, then councils could use it for bus route planning, increasing public transport etc. Owners of shopping centres could better understand who is visiting.

Oyster Data
Data from Oyster and other regional travel card data (e.g. Nottingham has a similar system to Oyster), in order to understand trip patterns and demand for services both in transport planning and ancillary services e.g. retail.

Census workplace flow data and Census small area micro data
Easier access to these would be beneficial. Currently these datasets have limited access due to disclosure control, which differentially impacts on private sector users.

Open up PSMA data to the private sector
To create a level playing field for the private sector and allow greater collaboration with the public sector.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A standard, universally recognised address file as open data in the public domain would be very benenficial, particularly if supported by accurate geospatial referencing, for linkage with other emerging datasets e.g. mobile app data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Whilst we support the opening up of datasets we are concerned for the continued funding to maintain quality. A number of funding models may be appropriate: increased liberal access for commercial users but at a cost, “fremium”/Spotify-type model.

Improved access should not necessarily be at a cost to quality.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

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Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	mySociety
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
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Call for evidence - three key themes

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Our questions

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

A key feature of working with geospatial data is that it can be joined up to any other geospatial data to create more useful and insightful analysis. Doing this on any scale requires analysis in a programming language or database software outside of COTS GUI platforms - most of which are closed source.

Skills development in this area should be understood as more than learning the skills required for particular platforms. It should take the shape of understanding principles that are broadly applicable across both open and closed systems.

New GIS startups depend (and will continue to depend) on language and framework knowledge (python/ postgis/ etc) rather than knowledge of suites such as ArcMap.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

A key problem across mySociety projects is helping people identify which administrative area they live in, to gain access to services, or identify their elected officials. One of the most common patterns used to solve this is a postcode lookup, which links someone's postcode with administrative area. OS CodePoint Open provides a free dataset that allows projects to do just this.

But postcodes do not necessarily sit neatly within administrative boundaries. Some postcodes span multiple local authorities or constituencies, meaning that software relying on postcode-to-boundary lookup will deliver the wrong results for around 70,000 households for local authorities.

The datasets that would allow civic tech projects to correctly allocate individual addresses to the correct area (AddressBase) or postcodes that cross boundaries (CodePoint Polygons) are closed datasets. The gov.uk service — which provides an 'official' citizen-to-representative matching service — has the same issue with boundaries despite free access to the relevant licences for public bodies. This reflects that open datasets can become a de facto standard through availability and ease of use.

Open licencing of the OS CodePoint Polygons and AddressBase would allow accurate identification of where an address falls, improving accuracy of civic tech and government websites.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

See answer to Q4

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission should focus on investment in open source tools and in the release of open datasets. New startup use of geospatial tools will be based on open source tools, open release of key geospatial datasets has a multiplier effect on the range and diversity of potential uses of the data.

Lowering the cost of entry for new services and products based on geospatial data will result in an increase in innovation that will produce a diverse range of end results.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	NAEA Propertymark
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**x**
Central government	
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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes, we agree with the accuracy of the geospatial data types provided.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We are not aware of any further areas of geospatial skills in which the commission could best focus.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

It would be valuable for estate agents to be trained in the use of Geographic Information System (GIS) mapping software, particularly for its use throughout the process of a sale and for marketing. GIS is a framework for gathering, managing and analysing geographical data, it can also be used to visualise the data – for instance, on an interactive map. Considering this, many estate agents will require training to understand geospatial procedures, workflows and software and how best to encompass this technology into their businesses.

Online courses and webinars are ideally suited to teach geospatial skills as they are both accessible and informative. The commission should consider hosting webinars for the various sectors included in this call for evidence. HM Land Registry provides webinars to understand the conveyancing process[1], which have been made freely accessible for the public on various devices. We believe the Geospatial Commission could replicate this service.

A bespoke geospatial skill course specifically for estate agents could be made available at varying levels of learning depending on demand. NAEA Propertymark offers courses for estate agents, some are online specific, and others can be location based or in-house. These are made available to both members and non-members. This course would then be advertised through our various communications such as mailers, articles, our magazine Property Professional and at events throughout the year.

The commission should consider working alongside private sector geospatial companies in offering training for businesses in geospatial skills. For example, Cadcorp[2] provides clients with the option of either a standard or bespoke training course – which can be provided on or off site. Cadcorp is used specifically in land and property for GIS land management, and has use for estate agents, property developers (such as McCarthy & Stone[3]), housing associations and lettings. Esri UK & Ireland[4] provides a 'Request a Demo' service, where those enquiring can select a date and time and make requests to tailor the demo to their needs. Esri works with both private and public sector clients such as: Knight Frank and the Greater London Authority. Bespoke training provided by private companies work well for all parties involved, encouraging relationships between the commission and the private sector and offering more choice for those who require training.

GIS maps can provide visually appealing and highly interactive marketing materials for estate agents, an example of this being OS Open Zoomstack[5]. OS Open Zoomstack is a comprehensive vector base map that shows detail of Great Britain's mapping down to street level. This technology could be utilised in virtual tour videos of properties online. It has a 'Fly to' feature that allows users to zoom in on a specified location through animation and has differing maps for day and night. An example of this could be using the night map to highlight local nightlife for those looking to buy in a quieter neighbourhood. If Zoomstack progresses beyond trial stage, estate agents would benefit from accessing the technology through a licence. Ordnance Survey should consider marketing this to the property sector by providing online demonstration and user guides.

Encouraging further knowledge of geospatial procedures, there is added benefit for NAEA Propertymark members as any courses or webinars taken part in could be logged as Continuing Professional Development (CPD), which they must

[1] https://www.gov.uk/guidance/hm-land-registry-requisitions#webinars

[2] https://www.cadcorp.com/market-sectors/land-property/

[3] https://www.cadcorp.com/files/uploads/resource-files/McCarthy-Stone-casestudy.pdf

[4] https://www.esriuk.com/en-gb/home

[5] https://www.ordnancesurvey.co.uk/business-and-government/products/os-open-zoomstack.html

participate in at least 12 hours of per year with a minimum of four hours obtained through educational events as requirement of membership[6]. NAEA Propertymark members already go above and beyond the legal requirements for estate agents[7], and we pride ourselves in being industry leaders, having geospatial skills will further the professionalism of our membership.

Finally, following the Government's announcement to regulate property agents[8], a geospatial skillset could be a requirement of being a regulated estate agent. We have long lobbied for the regulation of estate agents. Should regulation be introduced, to promote geospatial skills in estate agency - there should be an additional requirement in qualification, or at least the ability for legislation to be amended to add this requirement in the future to coincide with technological advances. This could include a basic working knowledge of using geospatial data or GIS in the sale of property and demonstrating a working knowledge of the software. This would ensure all qualified estate agents have a geospatial data skillset, thus futureproofing the sector for emerging technology.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The digitisation process of Local Land Charges must consider technological advances as most Local Authorities are not yet incorporated. Digitised Local Land Charges at the time of writing are limited to Warwick District Council, Liverpool City Council and the City of London Corporation, with only 26 local authorities' local land charges expected to be transferred by March 2019. Thus, the digitising process is still in its infancy and data migration is projected to take up to seven years[9]. Seven years is a particularly long time in terms of both governance and technology, and the commission should consider how this data migration will work alongside any advances in technology.

Making Local Land Charges digitally accessible is valuable to estate agents and their clients as it takes away some of the need for a solicitor or licensed conveyancer carrying out the search manually. Thus, this speeds up the process as the information can be obtained much quicker digitally than when requested manually by a legal professional to the Local Authority.

Ordnance Survey should begin integrating further details already publicly available into OS Master Map to further benefit user operability. OS Master Map Topography Layer provides registered land boundaries but does not then hold layer data sets

[6] http://www.naea.co.uk/join/continuing-professional-development-cpd.aspx

[7] http://www.naea.co.uk/join.aspx

[8] https://www.gov.uk/government/news/government-to-professionalise-the-estate-agent-market

[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700335/Local_Land_Charges_Impact_Assessment_BIS_LR003_HMLR.pdf

for ‘Price Paid Data’, which is freely available through HM Land Registry and the Open Government Licence (OGL). Considering that OS and HM Land Registry are partner bodies with the commission, we believe this collaboration would not face any challenges in a roll-out.

Collating this data in one source is beneficial for estate agents as it can be used for marketing and advertising purposes and allows for a simpler valuation process when vendors wish to sell. It would also be beneficial for consumers, as they would be able to access housing market trends when considering whether to make an investment in a certain area.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

There should be a standardisation of address data across the entirety of the UK. If this is not possible, the commission should consider creating an authority or standard that can combine devolved authorities address data. It is equally important that address data is verified to ensure accuracy.

The National Address Gazetteer should be fully utilised to support emerging technologies. It is managed by Geoplace which is owned by Ordnance Survey and the Local Government Association. This combines existing Local Authority data with further data from Ordnance Survey, Valuation Office Agency and Royal Mail Postcode Address File (PAF). This also includes Scottish data through a partnership with Ordnance Survey and Scotland’s Improvement Service. It uses Ordnance Survey’s AddressBase technology to match the PAF with the Unique Property Reference Number (UPRN). Almost 400 checks are ran on each record before Geoplace accepts it onto the database, meaning that each record is of high accuracy.

The commission will have to consider how to involve Northern Ireland authorities and the corresponding data to ensure a single UK standard, as Northern Ireland address data is not covered by the National Address Gazetteer. By ensuring a standardisation of address data, wider users of geospatial data in the public and private sector will be able to match up and complement existing data with clarity.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

It is not applicable for us to respond to this question.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission should focus on creating a Digital Log Book for each property that is bought and sold to speed up the buying and selling process and provide transparency and comprehensive information for all parties involved. This Log Book would be underpinned through geospatial data and information held by Land Registry (or the corresponding form of land registration outside of England and Wales).

Using geospatial data as a base this technology could go further. The Log Book should have sections for the different stages of the transaction, allowing for documentation to be uploaded from the various parties with dates for deadlines and timescales. This would be a hub for property information such as: boundary lines, flood and mining zones, historical ownership data and digital copies of home related administration such as the Energy Performance Certificate. This would allow for all parties involved to log-in and find out relevant information and ensure that they are more engaged and better informed.

Property chains can become long and complicated, and a problem at any point, such as simple as missing piece of paperwork can cause delays for all involved. An online filing system specific to each property sold would speed up the process and allow for documents to be loaded onto a central point and importantly be downloaded quickly and easily to produce documents on request. Furthermore, the conveyancing process requires information from various third parties before contracts can be exchanged. The Log Book would help to avoid delays and allow regular contact with the agent and buyer to help deal with any issues that arise.

By simplifying the home buying and selling process, a Digital Log Book would contribute to an increase in property sales, and consequently revenue obtained through churn and taxes associated in the purchase of property. To this end, less time, resources and energy from all involved parties will be put into long or failed transactions and more revenue will be generated for spending on local goods and services.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Through the creation of a commission approved geospatial standard and corresponding applications, it will provide a firm foundation to support enhanced roll-out of future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

It is not applicable for us to respond to this question.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The commission should prioritise the development of Global Positioning System (GPS) in land planning and development to efficiently source suitable locations. GIS complements GPS, combining the systems allows planners and developers to pinpoint the best location for a particular structure. For example, planning a new block of flats close to desirable amenities, or placing a commercial building in an area lacking in much needed amenities.

GIS and GPS software can forecast future needs, making it imperative that planners consider housing for the increasing elderly population. In our Housing 2025[10] report, we discovered that whilst 1.1 million households in England and Wales are overcrowded (4.5% of total households), but 16.1 million households are under occupied (making up 69% of total households). Despite a projected 48,000 additional private retirement homes by 2022[11], there will still be a significant shortfall of property for those at retirement age as the Government continue to prioritise building family homes. It is for these reasons that planners should now prioritise homes for downsizers.

Currently, there is a lack of suitable choices for 'last-time buyers'. In 2015, Legal & General commissioned a report which found that when last time buyers are looking for a new home, the most common preferences are being close to family and friends (32%), being near their current neighbourhood (18%), having easy access to healthcare (16%) and being located near shops (10%)[12].The same report highlighted the worth of this market at £820 billion.

Through prioritising GPS in planning of retirement properties, downsizers will be provided with more choice of suitable properties. Planners will be able to consider existing amenities and transport networks, whilst considering issues such as proximity to neighbourhoods and hospitals. They will also be able to make use of the software in planning new amenities to complement new housing developments for downsizers.

[10] http://www.naea.co.uk/media/1043988/housing-2025.pdf

[11] http://www.naea.co.uk/media/1047383/autumn-budget-2018-representation-to-hm-treasury-from-naea-propertymark.pdf

[12] https://cebr.com/reports/uk-last-time-buyer-market-worth-820-billion/

This not only benefits planners by making land sourcing simpler and better targeted, but also downsizers and the wider housing market. By encouraging 'last-time buyers' to downsize, existing larger properties will become available on the market, increasing churn through property sales and taking away some of the pressure for government built affordable housing. Through prioritising the use of GPS in development, the commission are futureproofing the planning and design of property and community infrastructure.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The role of the private sector will be crucial in opening up its own geospatial assets and data by working collaboratively with the public sector. The commission should consider working with privately held geospatial applications to encourage innovative ideas from the private sector.

Knight Frank, an NAEA Propertymark regulated company, has an entire team dedicated to geospatial data analysis in its research body. In response to the government's 2017 Housing White Paper in which the upward extension of buildings was discussed, Knight Frank utilised geospatial data to create 'SKYWARD'[13].

The creation of SKYWARD highlights that geospatial innovation from the private sector can also be exploited by the public sector. SKYWARD uses GIS software to systematically analyse the potential of every building to be extended upwards without changing the character of the skyline.

Knight Frank analysed 3D spatial data from Ordnance Survey, and cross referenced it with data from Land registry to assess ownerships as well as Historic England data in order to filter out listed buildings[14]. Knight Frank's study found that 41,000 new dwellings could be built in Zones 1 and 2 of Central London, just through utilising roof space.

Another working example of the private sector working alongside the public sector to exploit useful geospatial data is GetRentr[15]. GetRentr tracks regulation from across the UK that has impact on the private rented sector. Our sister organisation, ARLA Propertymark[16] is in a partnership with GetRentr that provides ARLA Propertymark members with a Licensing Database. This Database collates information from Local Authorities to provide a comprehensive list of upcoming property licensing schemes and consultation events. GetRentr provides this data by working collaboratively with Geovation, Ordnance Survey and HM Land Registry.

[13] https://content.knightfrank.com/research/1400/documents/en/skyward-2017-5111.pdf

[14] https://www.knightfrank.co.uk/blog/2017/11/15/more-than-40000-new-homes-could-be-built-on-londons-roofs

[15] https://getrentr.com/

[16] http://www.arla.co.uk/

To incentivise the private sector in the development of geospatial infrastructure, we would recommend that the commission considers allowing GIS specialists access to data that is not publicly available or licensable. The commission could also consider interoperability between the public and private sector where both parties benefit from sharing data, such as with GetRentr.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There needs to be a singular platform used for GIS mapping in the public sector across the UK. Geospatial data from across the public sector has many inconsistencies. Due to the fragmentation of data provided by devolved authorities, some GIS maps are full of useful layers and localised information, whereas others lack data entirely. This means that content across the UK is inconsistent, as is the software used by the Local Authorities making use of GIS maps.

A platform such as ArcGIS[17] should be adopted to marry existing geospatial data from the public sector, this would ensure consistent data mapping and a standalone form of software that is recognisable across the UK. ArcGIS allows for the creation of maps, sharing and community collaborating and is ultimately used to analyse data. The Government are already familiar with ArcGIS, as the Cabinet Office used this software to create 'Find Me Some Government Space' – the first public-facing GIS developed by the Office to improve public sector transparency[18].

We believe that through the creation of a singular platform, operability of public geospatial data will be improved. This will be achieved by removing the complications involved with different software being used for different devolved areas. By removing inconsistencies, it makes understanding GIS software simpler. This would allow those operating across the UK to navigate the data with ease

[17] https://www.esriuk.com/en-gb/arcgis/products/arcgis-online/overview

[18] https://e-pims.cabinetoffice.gov.uk/government-property-finder/Home.aspx

without having to learn how to use multiple forms of software within the public sector.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It is not applicable for us to respond to this question.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

It is not applicable for us to respond to this question.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The partner bodies of the commission should further integrate their data and ensure data sharing from other public bodies to create an aligned and standardised strategy across the entire UK. Ordnance Survey and Coal Authority hold data for England, Scotland and Wales and HM Land Registry only for England and Wales. As aforementioned in Q5, the National Address Gazetteer only covers Great Britain. Consequently, the commission will have to consider how best to work with the corresponding devolved authorities not covered by partner bodies.

These are the further bodies that we believe the commission should consider working alongside to develop a single UK-wide strategy:

- Land Register of Scotland from Registers of Scotland
- Land Registry for Northern Ireland from Land & Property Services
- Pointer from Land & Property Services
- OSNI from Land & Property Services
- Geological Survey of Northern Ireland (GSNI)

It is imperative that all areas of the UK work together to deliver the geospatial strategy to ensure that the UK becomes a figurehead. The commission will need to consider how a singular strategy would apply to the whole of the UK when in some of the bodies there is a lack of representation. In the charter for the Geospatial Commission, it denotes that it will coordinate with the Devolved Administrations without usurping their powers or impinge on their relationships with public and private sector bodies. Thus, the commission must make consideration of how best to gain relationships with the above bodies without contradicting the charter.

The commission should take inspiration from the EU INSPIRE Directive[19] in formulating a single UK strategy. Whilst this strategy accounts for environmental spatial information, it enables the sharing of this information across public sector organisations as well as allowing public access. This model allows for regional variation but ensures a single standard that can be understood across the member states. We believe that a similar strategy would work in aligning individual strategies across the UK whilst still encouraging regional variation. An existing example of this being Stamp Duty. Stamp Duty is collected at a national level, but the housing market is made up of differing regional markets, resulting in the criteria for paying Stamp Duty being different across the four countries of the UK.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

It is not applicable for us to respond to this question.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

To exploit the economic benefits of geospatial applications, broadband maps created through Office of Communications (Ofcom)[20] data and Esri marketing and business tools should be promoted for use in estate agency, to encourage property sales and simplifying decision making.

A broadband map of the UK will encourage residential and commercial property

[19] https://inspire.ec.europa.eu/

[20] https://www.ofcom.org.uk/home

sales. Data provided to the Financial Times by Ofcom[21] has been used to produce a broadband map that highlights the disparity of internet speed across Great Britain. Whilst this study highlighted how even in city centres there is issue with internet speed, this data is useful for prospective property buyers throughout the UK.

A study by broadbanddeals.co.uk indicated that 88% of respondents would be put off buying a property where there was slow or poor broadband connection, and the average homebuyer would be willing to offer an extra £6,500 on a property guaranteed to have excellent internet speed[22]. Considering this, datasets held by Ofcom are of benefit to estate agents and their clients. Scaling up this data for across the UK would aid in finding the preferential location for a prospective home buyer, speeding up decision making and the home buying process.

A broadband map will aid in the decision making of commercial buyers for businesses. In rural locations businesses often find their options for high-speed broadband prohibitive. Through identifying a location on a broadband map, commercial buyers will gain more clarity on what their requirements for broadband will be depending on location – this could mean choosing a better suited location where the business would not be required to set up their own high-speed line or being more aware of what they will have to do to achieve high internet speed.

Instead of focusing resources on attaining an adequate internet speed, businesses can focus on starting their business up from the new location straight away and direct their revenue towards hiring staff who will in turn make further contributions to the wider economy. Additionally, for businesses that set up their own internet service there is further economic benefit as they can become an Internet Service Provider (ISP) themselves. By becoming an ISP, it will encourage further buyers into the area, consequently bringing more income into the local economy and encouraging further property sales.

To enhance marketing tools and market research for estate agents, the use of GIS software should be promoted. We believe that most of these benefits currently lie within private sector applications that are optimised specifically for business.

Esri Demographics[23] is used to provide insight on the population and can thus be used to effectively target consumers as well as to source property that fits the criteria of clients. The software allows for targeted allocation of resources in marketing and takes away time from conducting in-house market research of local areas, where the GIS software collates data from many existing sources.

ArcGIS Business Analyst[24] provides users with a map-based means to segmentation. Through analysis of demographics, the map layers allow users to identify trends of specified demographics in the area. Through better allocation of marketing resources, estate agents will be able to minimise outsourced marketing

[21] https://ig.ft.com/gb-broadband-speed-map/

[22] http://www.naea.co.uk/news/august-2017/broadband-essentials/

[23] http://www.esriuk.com/arcgis-content/demographics-and-lifestyle

[24] https://www.esri.com/en-us/arcgis/products/arcgis-business-analyst/overview

as the software brings it in-house. These maps can be used to create compelling infographics to use in property sales, and to make clients more aware of the local area.

Both technologies are used extensively in real estate marketing in the United States, and we believe it would be beneficial for estate agency marketing in the UK too. Engaging and visually appealing media will encourage clients to use these agencies themselves, going some way in aiding in customer retention and loyalty where the marketing produces results.

Q18: Are there any other areas that we should look at as a priority?

We do not believe that there are any other areas that the commission should look at as a priority.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The main potential innovations that will rely on the use of geospatial data to roll out will be the Digital Log Book (discussed in Q7), and a public register of properties owned by overseas entities, which will be discussed further in this question.

Through the introduction of a property Digital Log Book, the commission needs to consider how a geospatial data rollout will correspond with General Data Protection Regulations (GDPR) and the Data Protection Act 2018[25]. Information identifying personally owned property falls under GDPR – and geospatial data in property often reflects property ownership. Therefore, we believe a digital property log book should be a log-in service, only showing details and information to those who have permission to, consequently providing a protection for the contained personal data.

GIS in property sales improves communications between estate agents and consumers regarding Consumer Protection Regulations by offering estate agents

[25] http://www.legislation.gov.uk/ukpga/2018/12/contents/enacted

simpler access to information that may influence a sale. This will impact on the Consumer Protection from Unfair Trading Regulations 2008[26] which placed more responsibility on estate agents to provide information at the point of marketing where it was traditionally a task of conveyancers. Classically, this information (such as proximity to an operating railway line) would be physically obtained and analysing existing GIS data against property proximity absorbs much of the need to conduct checks for influencing factors.

Further, we believe that by introducing a property Digital Log Book, it is an ample opportunity to go further by introducing a compulsory 'How to Buy' and 'How to Sell' guide to complement existing 'How to Rent'[27] and 'How to Lease'[28] guides produced by the Ministry of Housing, Communities & Local Government[29]. These guides could be uploaded digitally on the portal for involved parties to access, in order to explain the differing roles of estate agents, surveyors, conveyancers and mortgage advisors and what to expect of each involved party.

One of the many arguments for using geospatial data in estate agency is to make decision-making easier. Consequently, by providing many factors that could influence a sale to a customer in a singular format, estate agents will have a comprehensive list that goes above and beyond factors that may influence a property sale allowing consumers to make better informed decisions. Additionally, providing this information to consumers in the Digital Log Book will raise consumer awareness and allow them to revisit all provided information.

The commission should consider the Draft Registration of Overseas Entities Bill[30] and the data collected on overseas entities owning property in the UK. There is a need for more importance to be placed on the verification of this information and how it relates to ownership of property and land in the UK. The data must be accurate and coincide with future technological change around buying and selling property as highlighted in this document.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Geospatial organisations and dataset holders should be promoted for their services outside of the UK to further advance the UK's presence in the international geospatial world. This has already been witnessed with Ordnance Survey MasterMap being recognised as a global exemplar; UK Hydrographic Office's ADMIRALTY being used on 90% of the world's ships[31]; and the prominence of the British Geological Survey worldwide.

[26] http://www.legislation.gov.uk/uksi/2008/1277/contents/made

[27] http://www.propertymark.co.uk/advice-and-guides/renting/england.aspx

[28] https://www.gov.uk/government/publications/how-to-lease

[29] https://www.gov.uk/government/organisations/ministry-of-housing-communities-and-local-government

[30] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727915/Draft_Registration_of_Overseas_Entities.pdf

[31] https://www.admiralty.co.uk/

Through the creation of a single UK standard, the UK can highlight its presence through exemplar collaboration and organisation. Whilst in other countries there are stellar examples of geospatial datasets and applications, even the most geospatial ready state does not have a singular platform which collates the data and layers consistently across the country.

We believe that by setting a global example, the new platform will act as a template for other countries to replicate in their own geospatial policies and also provide recognition for the best of the UK's geospatial developers.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Although the UK is second behind only the United States for geospatial readiness, there are further exemplary models and practices in the US, Germany and Singapore.

We believe that the commission should consider existing GIS technology in the US as a basis for combining OS Mastermap with HM Land Registry Price Paid Data. In the US, GIS land mapping company GeoThinq has created real estate investment heat maps for various states such as Florida[32]. This data is made freely available and marks properties by 'sales hotspots' and 'investment opportunity' through prices per square foot. The map also has an optional layer for commercial sales transactions. Users can choose what layers to apply to the map, which is useful for both potential investors for conducting their own research, and also real estate agents in attaining data visualisation for marketing purposes. In the UK, online property portal Zoopla has an existing GIS map with some of these factors[33], however it is in a simplified format.

The commission should consider creating a similar GIS API to privately owned TaxNetUSA[34]. TaxNetUSA is a licensed property information geospatial software that allows users to search for specifics in property and land. Users can discover property value, property equity, view floorplans and refine the search to only include owner occupied property. It is a useful tool for the real estate market as it allows in depth segmentation in marketing, down to the year the property was built and the year the owner took out their mortgage.

TaxNetUSA makes the full names of homeowners and their full addresses publicly available to view. This leaves homeowners open to receiving spam correspondence from any business or person who has searched the geospatial data in their area. In the EU such publicly available identifiable data has potential to breach GDPR, so although the software would be beneficial to replicate in the UK, the commission may need to consider the ethics behind such data and the consent of land owners.

[32] https://app.geothinq.com/

[33] https://www.zoopla.co.uk/heatmaps/

[34] https://www.taxnetusa.com/

Germany was ranked third for geospatial readiness, scoring slightly less than the UK. Since 2012 Germany has had in place legislation that allows all federal government spatial datasets, services and metadata available free of charge for both commercial and non-commercial use and reuse.

In the initial roll-out of geospatial data, the commission should consider replicating the German model of making publicly-held spatial datasets free to access and reuse. This would encourage sectors to make use of the data, and after an initial period – the commission could consider introducing fees for the services, allowing for reinvestment and upkeep of the public geospatial data. With this, users should have to option to garner additional information from privately held geospatial datasets through a generalised licensing agreement (either with full access or pay per click). Whilst in the UK there is a plethora of geospatial data held centrally, it is not necessarily open or accessible for third parties, adapting the German model will remedy this.

The partner bodies should work together taking inspiration from the Singapore Land Authority (SLA)[35], and create a singular portal that integrates various elements from the commission's partner bodies. Singapore is rated fourth on the Geospatial Readiness Index. The SLA combined the Land Office, Singapore Land Registry, Survey Department and Land Systems Support Unit and was formed in 2001. The SLA focuses on optimising state land resources for economic and social development, working alongside the Government in developing geospatial policies. Multiple disciplines come together to generate new ideas, insuring that geospatial policy is not insular to one industry. It provides various e-services, but notably an online portal where users can search and purchase land information such as property ownership, survey plans and road line plans. Along with the digitisation of the UK's land registration, the commission should consider integrating purchase features of state land in with Price Paid Data and Local Land Charges. A singular public sector portal aids in removing user confusion and increases operability.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[35] https://www.sla.gov.sg/

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	National Centre for Earth Observation
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	

Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**The National Centre for Earth Observation is a research centre of UKRI-NERC**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definition of geospatial data types should not be constrained artificially – all data and information types which encompass “geospatial” AND “public sector” should be included for consideration by the Commission. This includes where:

- Public sector expert organisations collect, produce and curate products and provide services, (e.g. 6 Partner bodies; UKRI-NERC Centres such as NCEO, CEH, NCAS, NOC, BAS, BGS; Met Office etc.)
- The public sector is a user of geospatial products and services and would benefit from cross government arrangements, eg for cost effective purchase of services (eg AirPhotoGB, Public Sector Mapping Agreement)
- Government policy has a strong influence on the collection and curation of geospatial data, for example with respect to satellite Earth observation (EO) data.

We particularly welcome the frequent mention of satellite Earth observation data in the consultation document. At the simplest level these are additional sources of geospatial data and information but with some special attributes, including frequent wide area update, global long term comparability and the addition of a wealth of environmental information (e.g. on condition of land cover, temperature, crop health, water quality, atmospheric gases and aerosols etc). Brought together with the products and services already provided by the 6 partner bodies, satellite Earth observation enables a much wider range of products and services for government and in support of innovation in the private sector.

It is particularly important to realise that there is a vast amount of geospatial data produced by non-GC bodies. Bringing together GC partners with non-GC partners is essential for covering geospatial data types needed by the markets.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Innovation will come from bringing different data sets together and using them in novel ways.

- Encourage multidisciplinary teams, eg, geographers, data scientists, statisticians, ecologicals,physical scientists and mathematicians working together.
- Develop algorithms for data fusion, change detection
- Develop understanding of data quality.
- Enhancing digital skills including software, high performance computing and AI
- Skills in transformational geospatial techniques including satellite EO and new mobile sensors.

It is noticeable that UKRI is missing from the document. Working wth UKRI and the HEI section must be an essential component of any skills strategy; UKRI invests heavily in environmental science data sets through NERC and AI through EPSRC and other councils.

It is worth emphasizing the point that whilst geography must be a fundamental discipline, there are large efforts on-going in physical sciences and mathematics capabilities applied to geospatial data. This includes new sensor technologies, for example related to autonomous vehicles and UAVs.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In our organisation, the key skills needed are in physics, analytical mathematics and modelling, and high performance computing. The gaps are in location-based geography, high spatial resolution data processing and in links across geospatial technologies.
These gaps can be addressed by increased support of the HEI sector, by closer engagement with UKRI funding streams and by improved access to O/S type data.
A key area which needs to be addressed to accelerate progress in the geospatial sector is to attract highly skilled data scientists, mathematicians and statisticians enabling multidisciplinary teams to work together on a wide variety of problems in different types of organisations. The formation of UKRI should help to break down disciplinary barriers in research and innovation. A key area seems to be the support of HEI courses with requisite skills in geography, sensor technologies, mathematics, statistics and physics. It is not clear that the GC has considered this element.
Challenges, opportunities and careers need to be promoted in learned societies across disciplines, eg promote geography to data scientists and mathematicians and vice versa.
Ultimately people choose careers where there are jobs to go to with good pay and conditions. Does Geospatial Commission have a target in terms of new jobs created? £6-11bn for the UK economy means significant numbers of new jobs or retrained people.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There are two key areas: 1) access and 2) a collaborative ecosystem.
Data.gov.uk is addressing some questions of access but inevitably challenges remain, even where data and information products have been paid for by public organisations - licences, particularly for commercial or operational use mean some datasets are effectively invisible or, at best under utilised.
The integration of satellite Earth observation data remains a challenge: data suppliers span both the public and private sector. In the public sector, data sources are linked to international programmes, eg Copernicus where UK may have limited influence in the future due to BREXIT. Private sector supply is often expensive for initial feasibility studies, inhibiting innovation. In both cases government could act to improve data access. Simple moves could be transformational.
One of the key attributes of satellite data is long term data availability making

them suitable for detection and attribution of change – both detecting presence/absence of features (eg trees, water) and also looking at quality of landscape. Challenges are those associated with many big data sources – efficient and effective manipulation and processing – cloud based techniques, data cubes and the like offer potential but assembly of data sets in a suitable form for easy use is still a challenge.
Collaboration in the geospatial sector needs to cross the spatial dimension from the very fine spatial resolution to the coarser-scale scientific climate product. Techniques used to extract information in the environmental sector, including models, do not necessarily have analogues in the geospatial sector and this could hinder returns on investment.
Access to datasets such as OS MasterMap should not only be made available but taught to students and actively promoted to researchers.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Isolated and invisible datasets are more difficult to use than visible and easily accessible. If we want to truly exploit public investment in data then we must tend towards the latter rather than the former. This will require constructive change to achieve what is necessary.

The Commission cannot cover everything within its own team so two aspects could be very important. Firstly, ensuring key relationships are in place across government and the research centre world. Secondly, working with the other big government data initiatives would be cost-effective and bring critical mass: initiatives around space data led by Innovate UK and involving the UK Space Agency and the digital environment run by NERC. Thirdly, looking for projects between the partner bodies and other organisations that can exploit joint datasets (and models) in a synergistic manner.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The integration of Earth observation, where it is cost effective to do so, will be a key innovation step for the Commission. EO will augment more traditional geospatial data sources, providing new data layers, with frequent and wide area updates. Development of machine learning techniques will enable change to be tracked across the landscape, atmosphere and ocean areas of interest to the UK. For the public sector, examining change in key policy areas will provide evidence of where policy intervention is required and enable the effectiveness of policy to be assessed. Change could be on the timescale of hours (eg monitoring flooding) to years (eg monitoring the effectiveness of the 25 Year Environment Plan or the environmental impact of new road and rail infrastructure). Within this role, co-

ordination with the UK Space Agency, other government departments such as Defra and NERC will be essential.
First and foremost the Commission should provide the oversight of integrated UK government requirement for EO data and services with the objective of developing a government EO service served by appropriate satellites with routes to integration with non-satellite data assets and services.
Secondly, it should ensure that the UK has access to assets to deliver satellite-based EO data at requisite timeliness, coverage and quality.
At present a government EO service does not exist leading to fragmented activities related to individual requirements, a lack of use of skills and infrastructures already available and limited opportunity to provide transformational approaches better meeting government functionalities. The Commission should work with other stakeholders, particularly UK Space Agency, the Commission Partners and others across government and the research sector to articulate how government EO requirements are to be met.

- The commission should consider the whole value chain from satellites to identifying products and services to meet government needs. It should work pro-actively with government customers to mainstream EO data, through innovation, within the wider context of geospatial data.
- It should work with researchers and innovators to understand gaps between requirements and state-of-the-art. It should commission research and innovation projects to close the gap between current capabilities and government needs.
- It should make recommendations for EO data infrastructure to meet government needs, looking at both public sector and private sector data supply chains.
- It should set its recommendations in the wider context of innovation worldwide, both drawing on the best examples across the globe and helping to promote UK capabilities across the world. This wider dialogue will be important to support the UK geospatial industry develop markets.

An important issue going forward will be the architecture, implementation and governance of an operational government EO service. It is too early to say with confidence what this should look like but the Commission should be a key enabler. Cost effectiveness (eg eliminating duplication) and innovation should be key criteria for determining its recommendations.
The Commission should have a clear understanding that data is produced by sensors, whether on the ground or in space, and therefore geospatial data and markets are bound to sustainable and evolving observation technologies.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Satellite EO is an important technology, emerging rapidly from the research domain into operational services. Other technologies worth considering are for examples use of drones, mobile sensors on all transport vehicles and HAPS. Citizen science also provides a new dimension.
With respect to data processing the consultation document mentions are wide range of techniques and technologies: AI, machine learning, analysis ready data cubes – consideration of all will be valuable to make the most of the data collected and exploited by government. Methods to provide robust data fusion, understanding uncertainties in the data and processing in the cloud are all relevant.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The Commission should work with researchers and innovators to understand gaps between requirements and state-of-the-art. It should commission research and innovation projects to close the gap between current capabilities and government needs. UKRI has a Strategic Priorities Fund for which the GC and NERC would be obvious partners.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The government has at its disposal a wide range of business models and investment strategies depending on its primary objectives. A key decision point will be what the government will pay for itself and make available as free and open assets and how innovators will use these to develop opportunities in the geospatial applications. The evidence suggests that making basic geospatial data freely available drives innovation, for example making the Landsat archive available as free and open data or Google maps. Closer to home, there is good evidence from Environment Agency that making the Lidar data archive open access has created a significant increase in the number of users.
So the options which realistically lead to a increased marketplace are:

1) Free and open access with large numbers of users and a government-provided highway for UK PLC.
2) Free and open access for R&D in HEIs and businesses with streamlined access “at cost” for bespoke commercial services.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Recently concerns have emerged regarding our participation in the Galileo GNSS programme. It will be unfortunate if the UK has no part to pay in this important European programme.
It is important also to recognise the geospatial infrastructure now includes:

- The observing systems including satellites and mobile “on-ground and inflight” systems
- Systems for integrating positional information
- The data processing systems wich transform raw observations to information products
- The platforms for data access, analytics and archiving.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

The private sector should be involved throughout the value chain from data collection systems, including new satellites through observation systems such as satellites, data curation and processing to provision of products and services.
The role of the private sector will be an important consideration if the aim is to drive innovation and growth in the geospatial economy. The private sector could divide into two camps. Those on the “inside”, working as contractors to specify, develop and provide underpinning infrastructure and enhanced geospatial data assets of the 6 partner organisations and those of the “outside” who are looking to use the geospatial assets to address new markets and provide new services, generating revenue and profit and realising the large markets foreseen in the consultation document. There will also be tensions with the partner organisations themselves; what should be done “in-house” or “outsourced” to the private sector? Where do the partners’ expertise lie and where are the other centres of expertise or evolving capabilities.
The checks and balances between what is done by the public and private sectors and the role of research organisations will need to be carefully monitored in the initial stages of development.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to

improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As a research organisation, NCEO can generally get the data it needs to carry out research and development, albeit very inefficiently at times. It is not always clear what is available and what isn't; conditions for R&D are not always clear. Also data quality is not always addressed so how does a MasterMap compare to other digital elevation models? In general we have the skill sets to overcome lack of standards if needs be, but more telling for us is the lack of obvious training and engagement between different communities. Joint projects would start to overcome these barriers.
The really difficult problems come when trying to make the results of the R&D into sustainable long term services. The issues are well documented in the world of satellite data:, eg no long term guarantees of data supply; poor data access; lack of facilities to undertake big data analytics cost effectively. Some of these issues are being tackled by programmes like Copernicus – however at the time of writing BREXIT has resulted in significant uncertainty.
Depending on the breadth that the Commission needs to cover, support to build connecting digital infrastructure would be helpful. Common computing platforms and shared projects would enable new problem solving approaches with real potential for translation to the commercial sector. UKRI-NERC is working quite strongly on a new digital environment piece to which the Commission could link very nicely. In addition, organisations such as the Satellite Applications Catapult and the Defra EO Centre of Excellence have much experience and collaboration to offer.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Acting as an effective customer for geospatial data on behalf of the public sector is a very important role for the Commission. The Commission should provide the oversight geospatial requirements and ensure that the public sector is aware of what is available and what can be accessed in an efficient and transformative manner. There are some good examples already of collective thinking across government, eg PMSA and AirPhotosGB. In the area of satellite data some attempts have been made to identify value and understand requirements but much more needs to be done to be enable effective new government systems to be developed and implemented.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As NCEO, we are particularly interested in access routes to satellite Earth observation data, from both public and private sources. The attributes and potential value of EO data were noted in Q6.
The UK public sector holds a wide range of geospatial data, much of it open with its existence made known through data.gov.uk.
At NCEO, we also create data sets, mostly global and lower spatial resolution (typically a few hundred metres to several km), but increasingly paying particular attention to the UK. At this spatial resolution, there is a whole stream of sophisticated data products that inform UK bodies of current state from weather forcasting to climate change and ocean biology.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Firstly, dialogue and inclusion are the best approach. If relevant regional organisations are involved for the start, they are likely to be more cooperative. In addition, it is less likely that the strategy will be problematic because it does not recognise the factors that underpin regional variations.
Secondly, use the key government bodies and national research entities to inform the GC on areas where it has less expertise. The NERC community has long-standing activities in the geospatial area and in centres it has operational expertise. NCEO provides a championing role for expert research in EO systems in the UK, working alongside many bodies including the other NERC research centres such as BGS and the Satellite Applications Catapult. We recently held the national EO conference in Birmingham with the Remote Sensing and Photogrammetry Society and the Centre for Earth Observation Instrumentation. Over 250 people attended from academia, government and industry.
Thirdly, recognise that geospatial is a technical area which is evolving internationally. Access to good technical advice is crucial which will mean going outside the six partner bodies.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

This is a difficult area. Clearly working with local government co-ordination bodies is one route. A second route could be to work through local enterprise partnerships which , although focussed on business, convey a clear sense of the priorities of local leaders.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As a research organisation NCEO is not offering a response to this question.

Q18: Are there any other areas that we should look at as a priority?

This depends on the remit that the Commission is going to adopt. Entirely reasonably, the Commission is concentrating on issues within the purview of the partner bodies but then it will need to be transparent about this. It cannot then be following a mandate to be prioritising for UK government as a whole or indeed to be international as opposed to national. This is a not a problem per se as long as there is clarity.

There are a whole raft of issues which GC could support which are being handled by other government departments but where government systems for geospatial data could help. A few examples:

Climate adaptation and mitigation. For example, there is an active Space4Climate group which is looking at market applications of climate data and working with government to unlock value from such data.

Agriculture and food security. Defra is responsible for this within the UK but of course the UK depends on both access in the UK and internationally. Co-ordination between national and international efforts is lacking.

Coastal and maritime applications. Defra, Cefas, the National Oceanography Centre and Plymouth Marine Laboratory are engaged in such work. I am not aware of the interactions with UK Hydrographic Office, however this is likely to be a big area for the UK in the future.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There is a long list of potential examples, “new space” EO satellites, drones, autonomous vehicles, precision agriculture, city planning and environmental impact assessment. Brexit clearly will increase the regulatory challenge as recognised by Defra, for example, but there are many other areas from transport to energy.

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

Firstly it is essential to make the UK’s presence visible in the international geospatial world:

- to learn from the international community
- to influence international standards
- to export our know-how, products and services into global markets.

The consultation document provides some examples.
There are a number international bodies of relevance, including UN and intergovernmental organisations, eg GEO, CEOS, UN-GGIM, OGC, etc which provide UK good access to the world community and enable peer-to-peer dialogue.
The Commission should also consider how it makes its presence felt in international **user** communities.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

A good point to start is to analyse those active /leaders in the international community, eg Geosciences Australia and their data cube.
For benchmarking it is useful to compare with countries of similar size/GDP and see how they organise geospatial data. It may be useful to take a few examples which span radically different approaches.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	National Oceanography Centre
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**Non departmental Government organisation**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Introduction: Marine data management in the UK

The National Oceanography Centre (NOC) is the UK's centre of excellence for oceanographic sciences, with a remit to provide marine national capability and leadership for big ocean science at a global scale. NOC welcomes this initative to develop a National Geospatial Strategy.

NOC hosts the Marine Environmental Data and Information Network (MEDIN), which is a partnership of UK organisations committed to improving access to UK marine data and sponsored by 14 organisations, including the Natural Environment Research Council (NERC) and the UK Hydrographic Office (UKHO). MEDIN will submit a separate response to this call.

MEDIN effectively delivers marine data through a *network* of accredited Data Archive Centres (DACs). The British Oceanographic Data Centre (BODC) is the UK's designated DAC for water column oceanography, and is part of NOC. Although UKHO is the designated DAC for UK bathymetry data, BODC hosts the General Bathymetric Chart of the Oceans (GEBCO) and is the Global Data Centre for Seabed 2030, which is an initiative to map all of the world's oceans by 2030.

Within the UK, NOC is involved in an initiative with the Maritime and Coastguard Agency (MCA) and industry partners to develop and apply new Marine Autonomous Systems such as Unmanned Surface Vehicles for high-resolution seabed mapping. This forms part of a funding bid under Wave 3 of the Industrial Strategy Challenge Fund, and is being strongly supported by the Department of Transport. Previous attempts to initiate a UK seabed mapping programme have acknowledged the requirement to access the large volumes of seabed data held by industry in areas such as the North Sea.

The above examples all highlight the complexity of the marine data landscape in the UK, and the key role played by NOC in the archiving and dissemination of marine data, including global bathymetry. ***We therefore strongly urge the Geospatial Commission to ensure that NOC is a key partner in this initiative, working closely alongside UKHO (and complementing their domestic focus as a***

Partner Body) by providing access to global bathymetry and UK and global oceanographic data.

Questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes, although we suggest that **in the marine environment the impact of temporal change on geospatial data (including bathymetry) should also be considered**. For example, the MCA regularly commission bathymetric "resurveys" in key areas as part of the UK Civil Hydrography Programme in order to measure changes in seafloor bathymetry that may impact navigational safety, e.g. mobile sandbanks, channel infills.

NOC has world-leading expertise in global ocean and coastal modelling, and the measurement of global sea level, hosting the Permanent Service for Mean Sea Level (PSMSL). Changes in global, regional and local sea level will have a major impact on UK shoreline shape and character in the coming decades, influencing geospatial data from this dynamic environment.

NOC will be happy to support the Geospatial Commission through provision of expertise and advice relating to these observed and predicted temporal changes.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

NOC encourages the Commission to explore development of **intitiatives and training opportunities for assimilation and interpretation of data across the interface between land and sea**; the coastal zone is of particular strategic importance to the UK and developing geospatial expertise that is able to cross from the marine to terrestrial environment is key to understanding and managing this zone.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Not answered.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

There are currently large volumes of high-quality seabed and oceanographic data from UK waters that are held by industry (e.g. oil and gas, offshore renewables) that lack regulatory requirement for subsequent public access, even when commercial sensitivity is no longer applicable. Developing mechanisms to unlock and disseminate these industry data through the MEDIN network of DACs would be a good starting point for the Geospatial Commission.

As mentioned in Q1, **improved coastal bathymetry coverage, including quality and repetition of data collection should be a priority.** As well as rocky shores, UK coastlines are made up of mobile sediment that changes with the currents and waves. These sediments form channels, banks and other features that change the coastal bathymetry and morphology over time. Better resolved coastal bathymetry and morphology data sets, would lead to the improvement of modelling for coastal defence and management. Regular and frequent mapping of the changing coast poses a great challenge for data collection and integration, which would require improvement in autonomous technology.

Q5: Do you anticipate that any changes will be needed to both address data and the wider ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

See Q7 regarding Marine Autonomous Systems.

There is also a need to develop automated systems for effective and efficient data collection and delivery, and the metadata needs to be embeded within the data stream. **There needs to be investment in managing the data from the first point of collection to the end storage and use – from beginning to end**. There is also a need to develop existing systems and geospatial databases so that they are incorporated into wider information systems. Systems need to be flexible and agile and able to respond to developing applications and requirements.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

A potential risk that is already impacting NOC is that marine remote sensing is heavily dependent upon recruitment of EU and non-EU scientists to gain the specialism to interpret data - the NOC team comprises mainly international colleagues. Remote sensing is a specialist field that draws on expertise from a small international community.

It is also unfortunate that the dedicated MSc Remote Sensing course at NOC has ended due to a shortage of funding. Our hosting partner, the University of Southampton does, however, incorporate some training but this is only at undergraduate level.

In terms of investment, historically, marine Earth observation has fallen between the National Centre for Earth Observation (NCEO) and the NOC in terms of funding, with the consequence that obtaining funding for basic marine Earth observation (not applications) has been poorly funded.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

NOC is a world-leader in the development and deployment of Marine Autonomous Systems (MAS), having received £30M of UK Government investment in MAS in the current decade, including a £3M Marine Robotics Innovation Centre and the new Oceanids development programme, which forms part of the Industrial Strategy Challenge Fund.

MAS platforms (e.g. Unmanned Surface Vehicles and Autonomous Underwater Vehicles), their onboard sensors (e.g. multibeam bathymetry, biogeochemical) and softwares (e.g. automated command-and-control) provide opportunities to collect high-resolution seabed mapping data at reduced cost (and in some cases higher spatial resolution) compared to manned vessels - MAS will undoubtedly play a significant role in the Seabed 2030 initiative.

The ability for MAS to undertake long-term observations in all weather conditions allows great potential for measuring temporal change. And as well as generating geospatial data, these systems will require geospatial data for safe and efficient operation (see Q18). They are also able to transmit data in real-time via satellite, which is driving new data management tools within BODC to enable through-flow of these data to end users such as UK Met Office and Royal Navy.

Other technologies with varying levels of autonomy include fixed platforms (e.g. shore-based radar and the ARGOS beach camera system), passive drifters and satellites. Integration of these autonomous platform data, with other data sources, would lead to a seamless transition from land to sea when considering problems like flooding, sediment transport and coastal defence, or intertidal fisheries management.

The Commission is strongly encouraged to engage with the NOC to 1) understand

the full potential of MAS to collect and exploit marine geospatial data, 2) identify opportunities for MAS data integration with model and satellite data in order to develop a holistic 4D view of the ocean (see also Q8 below), and 3) explore mechanisms for seamless integration of data collected by autonomous platforms across land and sea.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Integration of satellite and model data with real-time data collected by autonomous and drifting platforms is a key research area for NOC and its partners, and is being applied in new projects in UK waters (e.g. MASSMO – Marine Autonomous Systems in Support of Marine Observations), and overseas as part of the Global Challenges Research Fund and the UK ODA agenda (e.g. SOLSTICE – Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research, focussed on the Western Indian Ocean). In addition to capturing information about the ocean, data captured can feed back information on how the technology is performing in the field, which in turn can be used to enhance vehicular performance. **Geospatial data layers (and model outpurs) can play a key role in targeting features of interest to the end user**, that are then surveyed in detail with high-resolution *in situ* observations.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

A fundamental requirement of centres like the British Oceanographic Data Centre (BODC) is to put data at the heart of research operations.

Some data centres also develop products. The Natural Environment Research Council gave BODC a clear remit to provide open data but not information products, and we believe that this has proved beneficial.

Data centres like the BODC have a role to provide the data and information to underpin the recommendations determined by the Intergovernmental Panel on Climate Change (IPCC).

Contributing data that has societal benefit is a key requirement of public sector organisations. The underlying value of this data is not necessarily reflected in its commercial value.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

It should be noted that many *in situ* observational platforms, including MAS and Argo floats, rely on the Iridium satellite network for data transfer. Radio and underwater communications are spatially limited and often challenging in the marine environment, so **investing in increased access to satellite networks and reducing cost / increasing resilience would provide a major benefit**.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

See Q4.

Also, on the instrumentation side, **there is a need to develop and build in standards for marine data that are interoperable**. We would like to be able to work with commercial companies, to be assured that when their sensors start to send us data, that we know what it is. There needs to be knowledge exchange about standards.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As mentioned in the Introduction and questions above, the marine data landscape in the UK is complex, and so **ensuring that all existing marine data can be obtained and assimilated will be a key initial challenge for the Geospatial Commission**.

There also needs to be a standard applied to metadata, to ensure all provides and users are speaking the same language. For example, if a data point describes a feature as 'rain' and another data point describes another feature as 'sleet', the technology that needs to read this, must be able to interpret 'sleet' as a sub set of 'rain'.

Vocabularies are used to describe the data - there must be clarity in description and interpretation. There should be standards in both vocabularies and interoperability. BODC is an acknowledged leader in the marine community in terms of developing vocabulary services, and would be happy to support the Geospatial Commission in this aspect.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

As mentioned in the Introduction, although NOC is not one of the initial Partner Bodies of the Commission, our role as the UK centre of excellence for oceangraphic sciences, and as the hosting institution of MEDIN, BODC, and the Seabed 2030 Global Data Centre, **should see us playing a key role in providing marine geospatial data and scientific expertise to the Commission**. We would be happy to discuss this in more detail.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As per Q4, **it would be beneficial to be able to access commercially-collected bathymetric data** that have been gathered for commercial surveys for use within derived products. e.g. seafloor bathymetry at high resolution. Although we appreciate that this type of data may include commercially sensitive information, if a version could be produced at a lower resolution, e.g. 200 m, this would provide societal benefit in terms of navigation.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Not answered

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We recommend that the five themes of Private Sector Use Cases should be expanded to reflect marine, for example:

Property and land – marine data can be used to enhance security of coastal communities in terms of preparation for storm surge and flooding events.

Infrastructure – as mentioned in Q1, marine data can help scientists predict flooding and storm surge events that may compromise infrastructure. In addition, the British Ocean Sediment Core Research Facility (part of NOC) collects data about deep-sea sediments. These data can be used, for example, to provide predictions about the likelihood of submarine landslides, which may lead to tsunamis. Information from deep-sea floor sediments may be used for mapping and surveys, oil and gas exploration, national resource assessment, pollution studies, laying submarine cables and the siting of seafloor structures.

Mobility – data that is derived from monitoring ocean circulation can be used to enable shipping routes to operate with maximum efficiency, saving fuel and time, for example.

All five themes could be enhanced by showing the need for and applications of marine data sets. For example, marine geospatial data can be used to help the UK manage the protection of its coastline and infrastructure (e.g. Thames Barrier), the identification of Marine Protected Areas, and development of sea floor maps to enable society to better manage precious seabed resources. Marine geospatial data underpin environmental impact assessments for marine renewable energy installations and their energy resource assessment.

Q17: Are there any other areas that we should look at as a priority?

NOC again encourages the Commission to ensure that the Strategy reflects the critical role of marine data in delivering societal benefits **both for the UK and the wider global community**.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The rapidly increasing number of Marine Autonomous Systems in UK seas will require a variety of geospatial data to operate safely and to meet regulatory requirements. In 2016, the UK Marine Industries Alliance (MIA) launched an industry Code of Conduct in respect of surface Maritime Autonomous Systems, however, this is a voluntary code, and new regulations around navigational safety will undoubtedly require real-time access to high-quality geospatial data, e.g. bathymetry.

Hot off the press – linked to the above, in October 2018 it was announced that the

Maritime and Coastguard Agency (MCA) and the Department of Transport (DfT), in collaboration with the NOC, sucessfully secured £1M in a bid to position the UK as a world leader in the autonomous and smart shipping industry. The funding, awarded by the UK Government's Department for Business, Energy and Industrial Strategy's (BEIS) 'Regulators Pioneer Fund', will be used to pioneer new ways of regulating and supporting the autonomous and smart shipping industries to help them deliver innovative new technologies to the traditional maritime sector.

The global autonomous shipping industry is predicted to grow into a $136 billion behemoth by 2030, with UK businesses already playing a key role. The funding will see the creation of a Maritime Autonomy Regulation Lab (physically based at the NOC), where regulators from the MCA and DfT can work with academia and support industry to promote on-water testing and flagship projects and help the UK grow its presence in the global marketplace.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

The Seabed 2030 programme is a high-profile international collaborative project, which will build on the NOC's contribution and commitment to the efforts of the General Bathymetic Chart of the Oceans (GEBCO) - under the auspices of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission - to provide the most authoritative, publicly-available bathymetry data sets for the world's oceans. **It is vital that the Geospatial Commission acknowledges and supports NOC's leading role in the Seabed 2030 initiative**, as it has potential to underpin multiple UK maritime interests, particularly in the Global Britain agenda.

NOC-BODC has been a member of a number of EU initiatives so it is important to maintain our presence within those programmes e.g. the Argo global array of temperature/salinity profiling floats. Some programes have developed into long-term infrastructure in their own right. For example the EU's EMODnet Programme has developed into a leading European endeavour to capture an array of environmental information, including bathymetry, seabed habitats, marine geology, biology, chemistry and physical paramenters along with capturing human activities in the marine encvironment. The sole purpose of the EMODnet Programme is to capture existing data and ensure that they are made available to the public and industry alike.

Another example of a key European programme is the European Multidisciplinary Seafloor and water column Observatory (EMSO). The key contribution of the UK to the EMSO effort has been to collect data from the Porcupine Abyssal Plain sustained ocean observatory, and this has been coordinated by NOC. The EC granted legal status to EMSO, which has been helpful in maintaining the longevity of the programme. If the UK is no longer involved in these programmes, our ability to influence and benefit from these programmes will decrease.

As mentioned in Q12, the UK can enhance its global visibility by building upon its capability in the innovation in vocabularies and interoperability. BODC is an acknowledged leader in the marine community in terms of developing vocabulary services.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We recommend that the UK notes the following points of comparison:

The Australian Marine Data Network

The US' NOAA National Centres For Environmental Information

Germany's Pangea Data Publisher for Earth & Environmental Science

The EU's EMODnet and SeaDataNet

The IOC-UNESCO's IODE

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Contributors to the National Oceanography Centre response:

[Text redacted] Government, International and Public Engagement Chief Scientist - Marine Autonomous and Robotic Systems

[Text redacted]
[Text redacted] British Oceanographic Data Centre

[Text redacted]
[Text redacted] Ocean Technology and Engineering

[Text redacted]
[Text redacted] International and Strategic Partnership Office

[Text redacted]
Marine Physics and Ocean Climate Group

[Text redacted]
British Oceanographic Data Centre

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	National Physical Laboratory (NPL)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Public Sector Research Organisation

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

NPL agrees that the view of geospatial data types within the strategy are accurate. However we believe that temporal data should also be included. **Accurate timestamping of all types of geospatial data will increase traceability of the data, facilitate comparisons across locations, increasing the confidence in the data.** Temporal information should also extend where possible to historical time series to enable climate or other changes to be evaluated.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

NPL supports the Government's inclusive approach to improving UK citizens' digital skills, including life-long learning opportunities, as addressed through the digital strategy.[1] It is important that all citizens have the skills needed to access, interpret and make use of digital data and this applies to geospatial data.

To increase the UK's capability in the geospatial sector, the Government needs to continue to invest in embedding mathematical skills at all stages of education and upskilling the workforce. This should include **basic knowledge of uncertainties in all stages of data processing**, with these skills being further developed and extended into all postgraduate geo-spatial skills training. Continual professional development opportunities are needed to support capabilities within the workforce covering uncertainty analysis, quality assurance (QA) and communicating this information. This could significantly enhance the strength of geospatial data and it would ensure that the maximum number of datasets can be meaningfully utilised.

[1] UK Digital Strategy, Department for Digital, Culture, Media and Sport (2017)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

It should be noted that NPL is largely an added value enabler of geospatial information rather than a user and so our needs are usually met by selected recruitment.

Within NPL we have identified **uncertainty analysis of imagery particularly at per pixel level as a specific skills gap**. We have been addressing this through developing tools and specialist training packages for the community.

The geospatial sector is expanding and new applications and uses of geospatial data are continuing to emerge. For young people starting school today, there will be new opportunities and careers in the sector which may not even exist yet. To ensure that we have a pipeline of skilled people to work in the sector in the future, the Government needs to continue to promote the uptake of Science, Technology, Engineering and Maths (STEM) academic and technical qualifications. There will be a role for the **new technical pathways and science apprenticeships** to help deliver the skills required for the sector.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

All data starts with measurement and it is essential that **good measurement practice is followed when data is gathered** for these geospatial data sets. This is vital at all stages of the process, and enables scientists to better understand the uncertainty associated with data sets.

In order for publicly accessible or privately held data sets to be utilised effectively and to improve the confidence in the data sets held, the methods of data collection and interpretation processes must be valid and there must be **clear traceability of the data including timestamping**.

Additional metadata must be made available to include information about the **sensors used to gather the data and information about when the instruments were last calibrated and to what standard, which will provide quality assurance (QA)**. We believe that at present it is still quite rare for any dataset (including that of major space agencies) to have all the necessary metadata to provide the QA information on the data set. Enabling this is something that the UK Government could do for the UK geospatial community as a whole and in doing so ensure the national derived information becomes extremely valuable to government and commerce and an exemplar for the world.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

NPL believe that the **accurate timestamping of data will improve the comparability and traceability of data generated**. The addition of robust quality metrics on the data sets, and in particular the means to remove biases and enable harmonisation and interoperability, will be fundamental to enable the exploitation through data processing software (i.e. data cubes) and machine learning environments. The provision of analytical tools near to the data sources (avoiding transference of large data volumes) and the incorporation of socio-economic data will open many new applications.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK should be working towards **standardising the infrastructure for the provenance of data**. To do this, it is essential that underpinning interoperable ontologies, architecture and analytical tools are developed. Quality assurance is required throughout the data generation process, starting with ensuring that the sensors meet the appropriate standards required, to have confidence in the initial data inputs. It will be important to coordinate the UK's resources to continue to build on networks that are already in place.

New methods for distributed calibration and validation of instruments and methods to remove biases under different environmental and observational conditions before ingestion into data hubs will revolutionise the exploitability of Earth Observation (EO) data. This will facilitate full usage of the new space providers into the mainstream information systems.

The commission should build from the Climate and Environmental Monitoring from Space (CEMS) JASMIN[2] facility **and establish a national database and analytical processing system together with an appropriate QA architecture as a tool for the community**.

[2] http://www.jasmin.ac.uk/what-is-jasmin/ (accessed 18/10/2018)

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission should focus on **Artificial Intelligence**, machine learning and the means to enable and establish robust interoperability and the provision of 'fit for purpose' quality metrics.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data can be used to **improve ground conditions monitoring from space**, including: changes in ground infrastructure over time, civil infrastructure movement and identifying landslips and flood damage.

It can also be used to inform the **creations of digital twins** for use in city planning, transport systems and Connected and Autonomous Vehicle simulation testing. Other applications include: pollution monitoring, agri-tech applications including the monitoring of crop diseases, planning for forestry management and estimating carbon stores.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The UK needs to ensure that there are **adequate calibration and validation sites** to provide data to validate satellite observations under a range of conditions.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

NPL is an enabler rather than user of geospatial data. We believe that **interoperability is and will become increasingly an issue**. Our research programmes are looking at how to make interoperable similar datasets such as datasets from Landsat 8[3] and Sentinel 2[4] as well as more complex linkages to Sentinel 3[5] and Sentinel 1[6]. **New standardised methods for scaling, spectrally and spatially are required.**

[3] https://landsat.usgs.gov/landsat-8
[4] https://sentinel.esa.int/web/sentinel/missions/sentinel-2
[5] https://sentinel.esa.int/web/sentinel/missions/sentinel-3
[6] https://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-1

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

When considering the maximum reuse of data and wide range of potential users the UK should seek to ensure **that high quality information is provided as the default**. Customers such as the Geospatial Commission need to be requesting quality data with uncertainty information as part of the procurement process.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

A coordinating body with a vision and regular meetings to build a **common comprehensive architecture for storing and exploiting data** could maximise the value of investments and facilitate maximum growth for the UK economy whilst ensuring all users are well served with comprehensive timely and trustable data.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

We believe that high risk sectors such as **finance, the energy sector** and other areas that are sensitive to climate change should be looked at as a priority.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The main potential private and public sector innovations that will rely on the use of geospatial data to rollout include **smart integrated transport systems across road, rail, marine and air**. These will increasingly incorporate systems for managing traffic (and therefore lanes/airspace) and the use of automated and eventually autonomous technologies both at the network and at the individual vehicle level. These will rely on a range of data including geospatial which must be trusted and traceable.

Autonomous vehicles will rely heavily on being able to access accurate geospatial data, making decisions based upon understanding their precise location and the location of other vehicles and objects in their vicinity.

Within agriculture there is the potential to use geospatial data to enable **automated farming**, capture data and inform the distribution of land use grants, monitor areas and inform risk mitigation processes and the costing of insurance.

There is the potential to utilise UK innovation platforms and concepts, to support developing nations, using additional data sets to improve the **targeting of aid**, mitigation of disease and monitoring of carbon accountancy sinks and emissions.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We can make the UK's presence more visible in the international geospatial world through the development of an innovative **data hub and analysis platform with quality assurance (QA) to deliver trusted products**. The ability to have full interoperability and encourage global datasets through UK architecture by providing interoperability/QA metrics alongside the data will place UK at the forefront of innovation. There are many data hubs and analysis platforms in existence or under development, so to make the most of the opportunity the UK has to develop something unique and act quickly to lead in this arena.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Australia has made a major global impact with the export of data cubes and is creating a digital Australia. They are also starting to look seriously at data quality assurance and interoperability as part of this process.

The US and US Geological Survey in particular have good platforms as increasingly do many in the private sector.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	National Records of Scotland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Data Scientists are needed as a vital role to work collaboratively with GIS analysts. There is a deficit of trained Data Scientists and as the Geospatial landscape changes they will play a pivotal role in its development. More needs to be done to train and recruit these individuals into the public sector.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As above for Data Scientists however a clearly defined career path within central government for both Data Scientists and GIS Analysts would be beneficial as a lot of these highly skilled individuals are forced to move into a middle management post in order to further their career as there is a ceiling to how far they can progress within their specialism.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Access

- Getting data: GDPR has added more complexity and restrictions, some of which are totally unnecessary. Most location data, or fixed property type data can be viewed from the street or is available from other sources in some format or another. Demonstrates a lack of confidence / not understanding GDPR by owners of the data.

- Data itself
    - No facility to download from supplier site.
    - No facility to select what data to download, rather than have to take it all
    - Organisational rules prevent direct download even from bonafide sites
    - How to access private sector data
    - Adding value. Restrictions on how other public sector data can be used/can't get it in the first place e.g. access to SEPA flood boundaries to map our Archives. Unable to make our own data free and open because of legacy IPR e.g. NRS digital postcode boundaries,
    - Licensing and IPR
    - Standards
        - No standards exist so difficult to incorporate other datasets
        - those that exist are not fit for purpose e.g. given the widespread use of address BS7666 needs to be reviewed, conflict with RM format resolved
- Quality
    - Links into standards but quality must be maintained. IROAddress data:

- the quality of source data varies between Council Areas, Councils must be adequately resourced to maintain core gazetteers and senior managers /Council Executives made responsible. Address life cycle must be maintained.
- the work to match RM PAF addresses to Council area address by GeoPlace (for OS) contains errors. [Text redacted].
- Aim is a single source of truth.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- Skills and knowledge. IRO Address. Existing addressing products are vast, complicated datasets which require significant skill to manage and interpret in order to extract information on records referring to premises whose identification required for census. General comment,
  - We don't possess the correct skills and knowledge
  - Require senior management to invest / buy in – which is best? A mix?

- Technologies – how do we know what's available to exploit our own data, where do we go for help? Definitely an issue for smaller organisations and ourselves.
  - Our existing website is not conducive to exploiting our data, Geography and other.
  - We don't know what we could do until we know what tools and technologies are available.

- Tools – don't always have correct tools/software to access/manipulate data.
  - Difficulties upgrading software
  - Difficulties obtaining new software
  - Exploit opportunities offered by Open Source

- Costs can be prohibitive e.g. access to OS data though this may change as more data is made open.

- Encourage partnership working across public sector organisations/public private sector ventures – addressing offers opportunities, save money, resource, benefit from external skills, knowledge, technical know-how, contacts etc. Requires change in mind-set and senior management buy in.

- Language – the language used is not necessarily easily understood by senior managers / those who hold the purse strings. Education required to help senior managers understand potential of what could be achieved by unlocking their data.

Given the widespread use and reliance of accurate location for organisations such as Emergency Services, work to roll out Broadband, Scottish Water, ROS and general communication between public sector and the public and accurate definitive address source is critical - a single source of truth. If the current product is not brought up to scratch, organisations will 'do their own thing' which is not in the public interest nor of benefit to the taxpayer – it is inefficient, costly and completely unnecessary. Instead improvements in back office systems and processes leading to greater efficiencies. For that reason we put forward outline proposals for the Commission to look at a Scottish addressing project, it could be in the form of enhancing what exists/collective project for something new e.g. set up an Address Hub. We think there would be significant wider benefits across a variety of government, private, third sector and commercial and infrastructure delivery sectors.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

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Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Digitising of archival maps and plans held by the national registers. (Scotland)
- Geotagging of the national archives (Scotland) in order to enable place based searching through thousands of records.

Use Case – New untapped historical geospatial data which has never been made available before. Various potential uses in family histories, land planning, archaeology etc.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

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Q18: Are there any other areas that we should look at as a priority?

Historical maps and plans being held in registers and geo-tagging of archival information from registers. (Scotland)

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Natural England
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Non-Departmental Public Body

Call for evidence - three key themes

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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Collated responses from across the organisation:

- I haven't seen geospatial data types described in this way before but it makes sense and acknowledges that any dataset may have spatial attributes.
- "Geospatial services" is probably the most vague term and from the definition makes it difficult to determine what may and may not be included.
- I believe the data types are well formed.
- In general, the view of geospatial data and data types is too human centric. This is understandable, but hundreds of thousands of species, across all kingdoms, are strongly represented in geospatial datasets.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Collated responses from across the organisation:

- The strategy recognises the need for training to be targeted to different sectors.
- If anything the current approach leads to polarisation and needs to recognise that those working in the environmental sector for example need a suite of skills (geospatial, computing, statistical, environmental and social science…) which are not mutually exclusive.
- School/College/University courses/modules to engage at an early age to ensure core skills are available when entering a workplace. Courses need to embrace more disciplines as well (i.e. not just computer scientists, ecologists, statisticians).
- There are very few industries that would NOT benefit from the use of geospatial skillsets.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Collated responses from across the organisation:

- Amongst geospatial professionals there is a tendency to focus on using geospatial data and GIS tools. In providing geospatial services there is a need to better exploit the wide availability of position data sources and to consider the use of a wider suite of tools for combing and analysing geospatial and positional data.
- Understanding how a place 'works' in a dynamic and interdisciplinary sense. It's not enough to be able to locate features and processes in a place; it is essential that we are able to put these together and understand the complex interactions between people and the natural environment in that place; and, crucially, how that place relates to other around it at and across various scales of time and space.
- General lack of understanding, not on what GIS can offer, but the sometimes complex nature of what is requested.
- Due to the great flexibility in GIS software and the products/outputs that are deliverable, some end users, for example, who request a "simple map", don't understand the skill required to deliver that map.

- School/College/University courses/modules to engage at an early age to ensure core skills are available when entering a workplace. Courses need to embrace more disciplines as well (i.e. not just computer scientists, ecologists, statisticians).

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Collated responses from across the organisation:

- Biodiversity observations datasets (species records) held by a range of organisations should be much easier to access. Much of the data is captured by volunteer surveyors, and then collated and managed by a wide variety of organisations (such as Local Environmental Record Centres, and national recording schemes and societies like Butterfly Conservation, British Trust for Ornithology), who then restrict access to the data. These organisations generate income from licensed data sales or create advantage in securing research funding or reputational benefits from ownership/primacy of publication of data. Public sector investment in many of these organisations ought to deliver publicly-accessible data, however this view is clearly not shared by many of those organisations, and the National Biodiversity Network (NBN) has for many years struggled to resolve this impasse. Declining public sector investment is driving some recording schemes and societies towards greater protection/restriction of data assets at a time when expectations are rising that data created from public investment should be publicly available.

  A national biodiversity data sharing infrastructure now exists (the NBN Atlas, https://nbnatlas.org) , however the intractable problems around access to data mean that this resource is not realising its full potential. Whilst the NBN Atlas currently shares >200 million species records, many of these are not made available openly or at full geospatial precision. Whilst biodiversity data is not openly shared, knowledge of the whereabouts of rare, important, threatened, protected, or otherwise interesting species remains out of reach, reducing the opportunities available to protect them or to enhance the natural environment for all to enjoy. Whilst Natural England may be granted privileged access to some of this data, we increasingly need to work openly with partners/customers who cannot access the same data. A further problem is that many data providers restrict access to ‘non-commercial use’ only, in order to protect income streams – disagreements arise over ‘commercial use’ is defined, creating further obstacles to use.

A current initiative, the Scottish Biodiversity Infrastructure (SBIF) Review, is exploring a new model for a sustainable biological recording infrastructure for Scotland, which may be applicable elsewhere in the UK. The draft proposals would bring about greater access to biodiversity data, but would require significant new funding.

- Detailed soil mapping is currently available under license from Cranfield Soil and AgriFood Institute. Whilst this is licensed to Defra the licensing restricticts the publishing of derived products which means that it is often not used and the licensing costs restricts wider availability.

- In general, the resolution of datasets can be a problem. For example, species observation data may be recorded at 1m resolution or 1000m resolution. Given the increasingly fine resolution of the satellite, LIDAR, drone datasets, we need to improve the resolution of all datasets going forward. Reducing the cost of fine-scale GPS capture equipment would help.

- Furthermore, the greater efforts to standardise datasets may be beneficial, as well as encouraging/improving data validation (e.g. removing free text fields wherever possible, or basic geospatial validation such as checking whether a giraffe is located in the middle of the north sea).

- Data standardisation, stronger metadata definition.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

No comments

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Collated responses from across the organisation:

- A pan government agreement for access to commercially available imagery.

- As the likes of ESRI and Google are increasingly moving into the EO space we should where possible look to collaborate rather than try to compete, for instance by offering UK Analysis Ready Data made available through their portals.

- Where possible though we should engage with open initiatives. True partnerships between government, commercial and academic institutions is key to exploiting EO through co-development of solutions and shared capability building.

- Beyond the platforms and data processing, the key requirement is sense-making and this requires understanding of underlying processes that give rise to the various patterns and images that EOI generates. While powerful and valuable, statistical modelling is not sufficient as it can offer no explanatory power behind the descriptions it generates. Modelling based on empirical evidence is essential to build and drive process-based models that allow for fully scientific approaches to analysing the data and extracting valuable knowledge. So while an AI/EO engine can spot particular animals in a location; track changes in numbers and spatial distribution over time and generate an idea of the trends and status of that species in that place (and also allow for projections into the future), the engine cannot explain the patterns observed or projected and hence cannot get to the underlying drivers and pressures acting on the system and hence allow us to design and implement effective interventions. So the Commission needs to blend the development of EO/AI capabilities with investments in strengthening underlying scientific capabilities, spanning the natural and social sciences, economics and humanities. Only in this way will we have a fully comprehensive and integrated knowledge system to inform our decisions and advice.

- It is vital that we continue to contribute to EO projects and secure access to future EO datasets. Nature technological progression will inevitably lead to finer resolution datasets that bring about issues not only to do with data processing and the CPU/GPU power required to access that data, but also the recognised storage implications.

- We should continue to strive for greater network speed and improved infrastructure to enable high speed access to these large datasets.

- We also need to find a way to improve the frequency of updates to

represent the rapidly changing landscape due to development, climate change, etc.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Collated responses from across the organisation:

- The Commission should focus on technologies that enable integration of data collection, curation, processing and sense-making; integrating statistical and scientific approaches and enabling practical, solution-oriented decision-support tools to be developed, shaped by decision-makers themselves in the context of the real-world decisions they have to make.

- EO, machine-learning, and validation (ground-truthing) to establish error margins and better inform decisions.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No comments

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Collated responses from across the organisation:

- There are opportunities to improve the quality of datasets through greater partnerships between government and non-government organisations. For example the Ancient Woodland Inventory is being updated through collaboration led by Natural England and the Woodland Trust. National habitat mapping could be updated using a similar approach to Open Street Map.

- Data assets can be enhanced through a clear framework for their integration; so that geospatial data carries explanatory power as well as descriptive power. So geospatial data assets are enhanced through an understanding of their interaction and the processes underpinning those interactions. So rather than a collection of data layers, there is a set of dynamic models underpinning and driving interaction between these layers.

- From a Natural England perspective, we have many data sets from hundreds of projects that are dispersed across many locations. This data would benefit from data validation (geospatial validation and cleaning) as well as greater data standardisation and accessibility.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Collated responses from across the organisation:

- Access to affordable fine scale GPS would benefit species observations and link to the increasing fine scale EO datasets we have access to.

- Shared/cloud based data storage to reduce duplicated data holdings and for sharing and collaborating with analysis.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Collated responses from across the organisation:

- Research and development of new and emerging technologies are where the private sector excel. We are in a position to guide them in terms of the requirements.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Collated responses from across the organisation:

- Whilst there has been significant progress in making data open, much of the public sector data holdings remains unpublished and are often difficult to locate. Positional data is a particular problem as it typically held in multitude of databases and data formats which are not interoperable. One challenge is that whilst there are portals for publishing data, such as the NBN Atlas (nbnatlas.org), the structure of the data (such as geospatial relationships) is often not retained.

- Data holdings remaining in non-digital forms with little or no incentive to digitise are major blockers. Easy access to rapid digitisation services is essential to realise the full value of these data.

- If we could standardise our own datasets it would be far easier to provide access to them via a standardised query/search tool. This data would then potentially be open to all via our open-data policy.

- The ability to search geospatial and temporal datasets across the many projects conducted over the years would far improve our ability to establish metrics of change over time, and our ability to correlate those changes to environmental change (climatic, development, etc.).

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No comments

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Collated responses from across the organisation:

- One issue we run into is the lack of open access data that allows a wide variety of uses with little or no constraints. Perhaps we should be encouraging great open-access data across the board?

- Species records datasets collated and held by a variety of non-public-sector organisations (eg Local Environmental Record Centres, or National Recording Schemes and Societies such as Butterfly Conservation, Botanical Society of British Isles, etc) contain millions of observations of species of direct interest to Natural England, Defra, Environment Agency and other public bodies. Access to this data is generally restricted – if more of this data were openly accessible at full detail, we would be able to provide better services – targeting conservation effort, understanding species status and drivers of change, evaluating our inverventions, meeting our reporting obligations, supporting local delivery, and working in partnerhship more effectively because we were able to share the same data without hindrance. Access to such data would be via a portal such as the NBN Atlas. See relevant comments provided under Q4.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Collated responses from across the organisation:

- Firstly - this requires a greater understanding of HOW public services can be better delivered and then a programme of education/information for local authorities.

- Local authorities are often resistant to change unless there are clear demonstrable benefits and efficiencies that can be achieved. I think this is best demonstrated through full proof of concept projects.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Collated responses from across the organisation:

- Natural England's Great Crested Newt licensing project has the potential to be rolled out to other species that require licensing activity. This project benefits both species conservation through the delivery of new habitat for the species (ecologically suitable areas that are geospatially identified at landscape level), but furthermore benefits developers through reduced costs and fewer development delays due to survey restrictions.

Q17: Are there any other areas that we should look at as a priority?

No comments

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comments

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Collated responses from across the organisation:

- Through the delivery of use-cases developed into peer-reviewed journal articles in high-ranking journals. Where key results from research are also deliverable, these results, along with all new methodologies should be presented at leading international GIS/industry conferences.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comments

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Natural Resources Wales
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Central government – Environment	**X**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There is some confusion over how geospatial data differs from positional data, this confusion occurs is with specialists within the industry so may further confuse none specialists or policy makers in the future.

What about other types of data such as big data and temporal data, how will these be considered.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

As a national environment organisation, we hold a lot of data, we have some good data analysis skills in house but now need to focus on advanced data management. I believe this is also where the commission needs to focus and promote the skills for the future. These should include

- Data Science
- Machine learning
- Smart algorithms
- BIM

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We have a good range of Geospatial skills within our organisation any skills gap are around data sciences. These can be addressed by working with other government organisations who have these skills such as GDS and the ONS new data sciences campus based in Newport South Wales.

As organisations we need to focus on analysis and digital professions, GSE and digital data and technology profession. Internally we try to promote professional memberships and charterships through AGI and RGS CGeog.

Careers in the Geospatial sector could be promoted with pay on experience and increased pay for staff with a professional membership and qualification. Some thought needs to be included in how we bridge the public private sector pay gap in the geospatial industry.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Before we target what data to go after the commission needs to focus their energy on what data sets will deliver the most results, if we open up OSMM there will be multi benefits for small businesses and we could see a “Geospatial Boom”. However, OSMM is not the be all and end all and another of other datasets or products would deliver better results if open.

Even in a small country such as Wales we don’t share data between organisations in the best way, particularly privately held spatial datasets. While we have a mechanism for sharing open data this is where we stop, a UK wide approach would help us with this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

I think as geospatial colleagues we all agree that location in particularly a physical address is most important.

How do we consider open addressing and in particular emerging technologies such as W3W. In some instances, for us as an organisation operating in remote locations this is more meaningful than a physical address. The stumbling blocks here is that W3W isn’t main stream enough yet. Thought needs to be given to how we can be help and promote future addressing enhancement and projects such as this.

Finally, the UK has a very good comprehensive address gazetteer, however we don’t make enough use of the UPRN. While this is used at a local council level usage could be expanded more to private sector, insurance companies, delivery companies etc. We all know and remember our postcode but hardly anyone knows about the UPRN.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

- Analysis ready data – involvement with Defra projects
- Concerns around a backwards step for earth observation post Brexit
- Lack of super computing resources for data processing
- Earth observations has significant cost savings in terms of field work and monitoring, but we need to re-invest these costs savings in technology improvements and enhancements.

Open sources vs proprietary software in EO, a lot of the support tools are developed by academics in the open source stack, how can we change the perception that open source is a challenge and burden I would like to see a push and lead from example here.

Continued access to the full range of products from the Copernicus programme is a must. In addition, we require access to higher resolution data – this could build on the contracts currently being put in place by the UK Space Agency but with two major changes – the inclusion of current data rather than just an archive, and permission to use the data for operational purposes as well as research projects and proof-of-concepts.

The commission should encourage more EO information sharing between the public, private and third sectors, for example, through funding events and web forums. It would be easier to share data with the third sector if public bodies were allowed to use open source software as a default, which is a win-win situation also minimising cost. Risk-averse ICT departments in public sector bodies may require steer from higher up in government to allow this.

One of the biggest issues with EO is the number of constellations, the way users access them and the different quality levels from each satellite. Could we have a data portal that centralises all EO data (open and proprietary), and options for joining this up with other forms of geospatial data and create a centralised data trading platform. This would be beneficial to query what data is available compare prices, quality, resolution etc. and have tools and infrastructure set up so users can process data to a level they want. An additional benefit can be reducing the number of systems/APIs users have to interact with a create a much smoother and easy to use system. There is potentially a lack of understanding about limitations of different constellations and by bringing them all together this could raise awareness about capabilities of these systems.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The whole spatial data lifecycle needs to change from capture to publish.

Capture – Investment in 5G to support mobile GIS, but not forgetting rural locations. Some places in Wales don't even have broadband yet alone any form of mobile internet.

Publish – The way each organisation publish data needs to change, some comprehensive organisations have their own open data portals which is great but some don't even have time and resources to publish to data.gov

Consume – The way we consume data neds to change, for the last 5 years at PSMA regional conferences we have reported back on how the PSMA should include data as a service… still waiting.

The use of drone technology is expanding rapidly in the public sector. It would be a great help if the Geospatial Commission facilitated a framework contract of commercial suppliers that public bodies could call off rather than bodies having to do this individually. Again, there is too much focus on economic growth here, to the detriment of other benefits such as resilience to enable rapid response during an environmental incident such as flooding or pollution

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Within our internal GIS strategy and 2022 vision for the future we have a number of aspirational future technology enhancements and projects that are reliant on new investments in geospatial data and applications these include.

- Enhanced real time data visualisation
- Augmented reality for species mapping

There are several other Welsh initiatives that will support future technologies such as:

- Wales City Regions
- Wales Valleys taskforce

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

More emphasis on invest to save projects and collaboration. We talk about key principles like publish once reuse many times and once for Wales, but we don't put these into practice enough.

Ideas such as a national data hub (not just open data) and a National Map office idea. Were all procuring similar or the same data sets several times individually at a huge cost to Government.

We have all data strategies and chief digital officers, the commission need to promote calibration and embark on a joined up journey.

Collaboration e.g. the Defra EO CoE. It is essential to include the Devolved Administrations.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

BIM and Indoor positioning are potential important activities for us an organisation in future. As is remaining part of the EU Galileo program post Brexit.

GPS is everywhere where is great, and locational applications are as popular as ever but how can we take this further such as differential survey grade GPS in our pockets and hand held devices.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Work together a lot more in a partnership approach, adopting a shared services model for data where possible. The current method of data sharing and capture is disjointed. For example, as an organisation we design and build a flood scheme, however OS will still go out and capture this instead of making use of our detailed engineering diagrams. Why not support the principle of re using information?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to

improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

We all operate different applications, standards and procedures therefore all face different challenges when sharing data.

A set of simple data standards would help us when sharing of data. Public sector licencing has got better over the years, but we still have a long way to go. Access to data is a key issue, understanding what data is available and who holds the data, data.gov has gone some way to help with this but this technology should be more customer focused and viewable in a spatial format to allow the use of wms/wfs services.
Lle in Wales needs more promotion, Local Authorities should be encouraged to publish data. The GC should have a role in promoting this and by promoting the advantages for the authority

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial commission needs to be the organisation that leads the way for both the public sector and private sector. The commission needs to dictate our strategy for the UK and work more with devolved administrations. The GC should be working with Welsh Government to push for a joined-up approach to ensure access to core data across Wales. Pushing for a Wales SDI that is resourced and managed.

Communicate with all public sector bodies to understand their needs then e.g. act as a bulk buyer for national coverage of high-resolution EO data – see question 6 - this could build on the contracts currently being put in place by the UK Space Agency but with two major changes – the inclusion of current data rather than just an archive, and permission to use the data for operational purposes as well as research projects and proof-of-concepts.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Were all data rich organisations and should share these across government with any boundaries or restrictions.

Planetscope data at high resolution. Access could be through a portal similar to Defra's Alpha project which includes Analysis Ready Data and high-speed processing in the cloud.
See also questions 6 and 13. Expand the archive of high resolution data currently being purchased by the UKSA to include up-to-date coverage and operational

use.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Learn from the big 6 but recognise that these are not the only organisations leading the way for geospatial. My own organisation creates more data than some of them.

We need to clearly set out our strategy and vision, but don't reinvent the wheel learn from devolved organisations and other international ventures.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

In wales we work closely with local authority, central government, education and the third sector. AGI Cymru has 12 active members from a variety of backgrounds to help give wales a voice, this is all volunteer time.

As professionals we shouldn't underestimate the involvement of local authorities and their use of data. In my organisation we produce dataset's that are used by 22 local authorities and often get a variety of feedback from them.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Natural Resources Wales is the organisation responsible for environment issues in Wales. Our purpose is to ensure that the natural resources of Wales are

sustainably maintained, enhanced and used, now and in the future. As our core remit is around the environment most of our geospatial data fits into the natural resources category. In Wales we need to scale up a national geospatial database, connecting to one Wales wide national database would have huge time and cost savings.

The emphasis on economic value alone here is disappointing and overlooks key sectors such as health and wellbeing. In Wales, all decisions by public bodies must be taken with reference to the Well-being of Future Generations (Wales) Act 2015. The Geospatial Commission need to be aware of this and also take it into account when acting on behalf of the whole UK.
For the individual, if they do not have their health then none of those bullet points matter. The Geospatial Commission must take into account that the governments of other Devolved Administrations have priorities other than money.

Q18: Are there any other areas that we should look at as a priority?

Health and further education are often the forgotten sectors in the geospatial Industry.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are a number of current UK big infrastructure projects such as HS2, Heathrow third runway that will utilise huge amounts of spatial data and geospatial technology. These projects should be embracing and promoting spatial e.g. a third run way open data portal, bringing together all of the spatial data sets. As a country we underutilise a chance to promote spatial data in situations such as this.

Real-time monitoring. Privacy and security issues.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

I think the UK has a presence in the wider international geospatial market however I think this is limited solely with a data and data capture focus e.g. OS international. Our presence in the international geospatial world needs to focus on more than just data capture, particularly analysis and the use & impact that spatial data has on problem solving.

Fund specialist public sector employees to attend high profile international conferences e.g. hosted by overseas Space Agencies or organisations such as the European Geosciences Union (whose annual conference now has over 15,000 attendees).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

As part of the GIS & Spatial strategy in Natural Resources Wales we have conducted a literature review of other similar geospatial strategies and documents. Australia, New Zealand and Canada all had excellent geospatial strategies which our organisation has learnt from.

European Space Agency – openness of governance, data and software, speed of delivery, culture of collaboration.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Network Rail - Buildings & Civils: Safety, Technical & Engineering
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I believe that the four proposed data types are sufficient.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

More emphasis should be placed on providing skills around improving the underlying data quality rather than the exploitation of 'art of the possible' and the aspirations/desire of delivering BIM compliant projects. BIM technologies are impossible without high quality interoperable data (with full meta-data) underpinning the foundations.

We should focus skills on the longevity and interoperability of datasets. Encouraging industries to developing geospatial data that could have benefits across other disciplines would reduce the silo-mentality that currently exists.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a big division of geospatial knowledge between geospatial practitioners and more senior figures who are being influenced by external industry. In large organisations there often tends to be very little internal review of their own capabilities from senior figures before initiating 'revolutionary programmes'. Geospatial practitioners spend too long managing expectations of high-level geospatial concepts whilst they are firefighting the basic data quality and data improvement issues.

There are pockets of excellence in some areas of the business but we lack the overarching backing of the company to actively recognise cross-organisational geospatial issues as fundamental to what we do.

The Cabinet Office could actively encourage cross organisation collaboration for the benefit of all involved.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Our organisation spends far too long concerned with the politics and licencing of data than we do with data quality and exploitation of the data.

For example, Network Rail has been denied PSMA twice from the Ordnance Survey. This has significant costs to our business, our innovation, data sharing across our supply chain and our delivery of works.

We often end up using the lower quality open source data in favour of the preferred OS MasterMap data / OS Water Networks, OS Highways etc. This is reflected across many industries. Opening up the best available data to all businesses will inspire innovation from all industries. Network Rail would be

available to provide enhanced, more accurate decision based solutions if they had access to particular data sets.

This has a knock on effect to the accuracy and applicability of our own analysis. We have considerable contracts in place with other organisations who also act on behalf of government departments. The administration and management of these contracts alone divert a significant amount of geospatial resources that could otherwise be employed on more data enhancements and exploitation.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Addressing is a fundamental part of how our country operates. The omission of Royal Mail from the commission is a concern.

Likewise the omission of the Meteorological Office is a concern. Weather and climate data should be open to all to use and interpret.

With emerging technologies enabling a more personalised mobile society, will future address data need to adjust likewise?

Network Rail has the requirement to address several assets that would not normally receive a standard address point. Bridges, access points, and locations that do not necessarily have direct road access require hierarchical geospatial positional information similar to the way that postcodes currently work. Addressing needs to move beyond building delivery points to introduce an interoperable cross-organisation standard.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Earth Observation is one of many data sources. Like many datasets, it has benefits and disadvantages and is suitable for a select number of applications.

One of the biggest advances in a wirelessly connected world for Network Rail is the potential of near real-time monitoring. Installation of ground based Remote Condition Monitoring stations across our highest risk assets have enabled the business to receive near real-time data on the condition of assets. This only provides feedback on monitored assets. Earth observation technology offers the potential of remote monitoring without the need for fixed infrastructure that would otherwise need its own maintenance.

Earth observation will never replace constant monitoring of assets as it is not real-time but does provide the opportunity to receive periodic snapshots of asset conditions. This would enable retrospective monitoring of asset degradation or land use change.

Currently Sentinel based earth observation technologies don't provide nationwide coverage due to the angle of sensors and the orbit. Also the resolution varies across the country. This prevents a national organisation from fully adopting such a data source. National consistency is one of the biggest benefits of Ordnance Survey data.

Acquisition for earth observation data is on a large tiled basis only. Therefore linear infrastructure owners would have to acquire / process large data sets containing unnecessary information rather than a specific area of interest.

As with all raster based datasets, EO data is large and requires significant resources for storage. The geospatial commission could investigate the potential of centrally hosting such services across multiple businesses.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Organisations should not be forced to adopt one particular format as this could be very restrictive. The Commission should focus on the development of (meta) data standards and data integration. The commission should be seen as the enabler to reform the interoperability of data between organisations by enforcing minimum standards.
Perhaps the enforcement of open source data standards would enable software vendors to better integrate and share data across organisations.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Consistency of geospatial referencing and addressing across organisations through enforced meta-data standards.

Possible mobile address system that enables personalised delivery of information / physical objects based on the individuals location.

The integration of open transportation and travel time information would ensure all delivery services could provide more accurately predicted delivery windows for products and services.

The integration of geospatial data from multiple organisations could open up

possibilities of infrastructure sharing. For example utilising the railway corridor for additional services / cabling / UAV delivery routes etc.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

By opening up geospatial data, organisations would lose potential revenue from selling to other businesses. This loss of revenue would need to be quantified and compensated for in order to encourage the openness of data sharing.

Public sector investment should also consider improvements to data quality, maintenance and assurance to continue to deliver to meet the needs of the end users.

There is a potential option for connecting public with private sector organisations in order to develop a more sustainable investment model for geospatial strategies, rather than considering them as separate entities.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Increasing nationwide coverage of technologies upon which geospatial data relies. Technology becomes very limited from a national organisation perspective when you can only access it in densely populated locations.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Without mandating any data sharing / delivery to public organisations etc there is no incentive for private companies to open up their data.
Private organisations need to be incentivised to deliver collaborative projects that minimise impact on end users. For example, utility companies should share access arrangements to buried services rather than repeatedly digging up the same piece of road inconveniencing the general public.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Data alignment and interoperability are probably the biggest issue. There is such a variety in data quality with little or no meta data. The mandating of data standards would alleviate some of the frustrations associated with cross-organisation data sharing.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Enforcing a mandate of geospatial data quality / sharing agreements / meta data standards and interoperability standards.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

I believe that the proposed 6 partner bodies limit what the commission could achieve. By broadening the scope of partner bodies it would be possible to engage with a wider audience and enable the Geospatial Commission to gain influence across a more diverse range of industries.
Other industries that should be involved include:
Transportation:

1) Highways England (and their equivalents across the UK)
2) Network Rail
3) Regional rail / tram / light rail providers
4) Local Authorities roads

Addressing:

1) Royal Mail
2) Local Authorities

Aviation

1) CAA – in a world of increasing UAV use
2) NATS

Meteorological

1) Met Office – with increasing issues relating to climate change it is important to share this data with other partner bodies

Earth Observation

1) Sentinel data – Whilst this data is available to use, it's current delivery mechanisms prevent it from being more widely adopted.

Environmental

1) Environment Agency (and their equivalents across the UK) – ensuring consistency across borders.

Whilst Opendata.gov.uk provides access to a lot of geospatial content, this needs to be enhanced. The user interface for interaction with data should be geospatial. Enabling users to query data on the fly online would prevent the need for business to constantly download data.
The tracking of data concurrency is difficult and users should be able to receive notifications of when a data set they have downloaded or 'follow' is updated.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Devolution across many industries has benefits and pitfalls. Ensuring geospatial consistency and compliance with standards across multiple devolved organisations is very difficult unless it is mandated from the government.
Future geospatial innovations will have limitations without consistent approaches across the entire country.
Unless the geospatial commission looks to promote and mandate standards then it will be very difficult for the UK to become a leader in geospatial strategies and innovations.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Mandating a national standard of data quality & meta data along with the necessary investment in high quality data capture to ensure the concurrency and accuracy of data.
Incentivise with financial reward for compliance and financial penalties for non-complince.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

OpenStreetMap offers subscribed members the opportunity to contribute to the base map to enhance the overall offering. By enabling crowd-sourced rule-based editing for certain Ordnance Survey products could enhance the data offering, especially in more rural areas where there are less frequent updates to Ordnance Survey products.
Ensuring that any data captured by local authorities or utilities organisations complies with and synchronises with Ordnance Survey MasterMap data.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The extended use of UAVs would certainly benefit from enhanced geospatial accuracy.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

In order to enhance our visibility we need to be seen to be more open and more collaborative than we currently are. Ultimately tax payers are funding data sharing across government organisations multiple times despite already paying for the data capture. This is seen as a massive waste of government resources.
The UK can't become an international standard of excellence in this area without first breaking down the barriers that prevent innovation and collaborative working within its own government.
Lead by example.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Integrated public transport services are made possible by understanding where and when services interchange. Many European countries provide significating

Opening up visibility of services could increase economic value. For example live train tracking software enables smoother transitions between public transport. See this example of live Swiss trains.

www.Maps.vasile.ch/transit-sbb/

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Network Rail (Asset Information Services)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes they are

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Working cross industry iniatives
- High quality interoperable data with full meta-data to common standards so that users of data can assess what a given data set can be used for
- To improve the interoperability of legacy data/information
- Legal issues, e.g. liability for any data reported about 3rd party assets
- Security issues, e.g. security concerns over critical infrastructure
- Potential impact on revenue for data suppliers, e.g. lost revenue from services
- Historically no incentive to move beyond the bare minimum re information supply
- No clear mandate from govt. to share information
- Differing levels of technological advancement re provision of electronic data; cost of technology improvement a potential barrier and could be perceived to outweigh any benefits from sharing information
- Commercial sensitivity issues
- Lack of central repository for companies to securely store/update their datasets

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- Aerial survey/drone capture and LIDAR
- Augmented Reality
- FME analysis
- CAD skills
- Need more focus on data quality and data improvement
- Administration/Management of contracts use a significant amount of geospatial resources
- Basic compentancy in understanding geospatial data for front line staff

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Though being declared as a wholly publicly owned entity Network Rail (NR) has consistently been refused entry to the Public-Sector Mapping Agreement (PSMA) on commercial technicalities. This has limited NR to an "Area of Interest" (AOI), restricting the amount of data available to the business. When extra data is required beyond the AOI, it has been at an additional cost both in terms of the extra geographic coverage required and the specific OS Mastermap (OSMM) derivatives needed. Though OS' negotiating position has softened and informal membership has been tabled it would still require NR to maintain its substantial financial contribution, the resources could readily be redeployed to drive innovation regarding the use of Geospatial data within the management of the GB rail infrastructure.
- In general licensing of data is challenging/ time consuming/ (including NDA's)
- After meeting with one of the Geosptial Commission reps – my understanding is that both the Royal Mail and the Met Office are not included in this commission – this is concening as this is type of data should be available

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- Investigate emerging technologies such as What3Words to integrate and make interoperable with existing gazetteers.This would allow the UK to utllise other address technologies and software which would not be constrained by the limitations and complexity of GB addressing (NLPG/AddressBase/PAF). This would broaden choice and strengthen the commercial procurement of the UK public sector.
- Network Rail has the requirement to address assets that would not normally receive a standard address point. For example bridges, access points, and locations that do not necessarily have direct road access require hierarchical geospatial positional information similar to the way that postcodes currently work.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- Earth observation data is on a large tiled basis only. Therefore linear infrastructure owners would have to acquire / process large data sets containing unnecessary information rather than a specific area of interest.

- As with all raster based datasets, EO data is large and requires significant resources for storage. The geospatial commission could investigate the potential of centrally hosting such services across multiple businesses.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Open source data standards
- Commission should focus on the development of (meta) data standards and data integration.
- Industry and Asset specific feature extraction tools to collect and validate national infrastructure data sets

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Augmented Reality eg BIM for stations, tunnels etc
- Geosptial/Location data has to be at the heart of an integrated and automated transport infrastructure system, this applies to multi model transport – specifically automated train operations (ATO) systems and driverless vehicles, both personel and commercial

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Increased collaboration between public sector organisations which would include the rationalisation of databases
- Loss of revenue (from selling data) would impact companies willness to participate in data sharing – this would need to be quantified and compensated
- Need to create a new economy which quantifies the value of the exploitation of data and shift the focus away from recovering the cost of data collection and treating data sets themselves as commercial assets.
- A national central repository for all authorities and utility companies to share their information in a geospatial format (underground assets specific)

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- Importance of 3G/4G/5G coverage to be very high so that reliability of using GPS.
- Also increased number of satellites if cost permits. Regardless of Brexit outcome the UK's ongoing participation in the Galleo Project or an equivalent must be secured.
- For Network Rail - Certainly a need for all locations to be captured with high resolution eastings and northings rather than ELRs and mileages.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- Increased competition between private firms will arguably raise the standards in data quality, if they are going to secure contracts etc - so there is a role for private organisations. (concepts such as BIM)

- Without mandating any data sharing / delivery to public organisations etc there is no incentive for private companies to open up their data.

- This is particularly showcased in the example of Utilities Companies – there are pockets of best practice here and collaboration, however many will not participate in Data Sharing initiatives. The Vault initiative in Scotland is an example of best practice.

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Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Data alignment and interoperability
- Data currency and accuracy issues.
- Also knowing who to contact regarding datasets and which are the most up to date.
- Example : every local government has a different approach and standards, which could be standardised. Devolution should still require consistent standards.
- The commercial constraints placed upon the use of OSMM and other premium mapping data products by OS requires NR to maintain several staff to oversee sub-contractor licences as well as data sharing licenses with our vast supply chain and the wider railway industry which consists of both private and public-sector organisations. The administration of this is time consuming and often exhausting as organisations challenge the terms of boiler plate licenses, legal agreements, and caveats regarding data reuse.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Enforcing a mandate of geospatial data quality / sharing agreements / meta data standards and interoperability standards.
- Some of NR's key datasets contain legacy OS IPR embedded within them, this has stifled NR's ability to produce truly open datasets. This in turn has frustrated the wider railway industry, academia, and contributors as they must sign up to legal agreements and sub-contractor licences limiting any commercial data reuse and therefore negating any benefit that might be gained through data driven innovation/R&D. NR has recognised this and has invested a significant amount in survey and data cleansing activity that will ultimately lead to the ability to produce these datasets in a truly open manner after removing any legacy OS IPR.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Met Office
- Environment Agency
- British Geological Survey
- Highways England,
- Utility companies such as telecoms, water, gas and electricity.
- Network Rail and other regional rail / tram / light rail providers
- Local Authorities
- Royal Mail
- CAA
- Local authorities

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- Ensuring compliance with standards is very difficult unless it is mandated from the government.
- More support for legislation that guarantees' open data within the public sector and cross industry

- Unless the geospatial commission looks to promote and mandate standards then it will be very difficult for the UK to become a leader in geospatial strategies and innovations.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Regular stakeholder groups to ensure consistent standards across local authorities.
- Incentivise for compliance and financial penalties for non-compliance.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- OpenStreetMap offers users the opportunity to contribute to the base map to enhance the overall offering. However if OS data was fully open and free to use, OpenStreetMap would not be required?
- Crowd-sourced rule-based editing for certain Ordnance Survey products could enhance the data offering, especially in more rural areas where there are less frequent updates to Ordnance Survey products.
- Ensuring that any data captured by local authorities or utilities

organisations complies with and synchronises with Ordnance Survey MasterMap data. (MetaData standards/ Inspire)

Q18: Are there any other areas that we should look at as a priority?

- Environmental eg weather, geology, soils, flooding, rivers, coastal erosion etc

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- For Network Rail , an example here would be the Digital Railway - this will be dependent on GPS etc for ETCS and real-time positioning systems. ATO as referred to earlier in the questionnaire

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- Increase collaboration and engagement, and be involved with cross industry projects to increase the UK's reputation.
- Geospatial Consultancy should be added to all UK trade showcases

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- This question identifies the value of sharing best practice on the international stage with stakeholders involved in similar work.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Newcastle City Council
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes, seems reasonable

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Short technical courses are extremely expensive. University and college course are often too broad and not focused on particularly outcomes. Some subsided funding for these would go some way to filling that skills gap.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

With eight years of austerity most of the GIS resources within our Authority have been lost. So, skills and resources wise we are probably worse now than we have ever been. We have made five GIS Officers redundant and hundreds of GIS users have left over that period. These are not going to be replaced any time soon. In association with lack of skills we have seen a huge reduction in in GIS projects and a degradation in the availability and quality of spatial datasets across the authority. Data that we have are often locked away and won't be shared because of fears over quality.

There is very limited budget for GIS training.

There is a pressing need to fund or subsidise training and provide technical courses in 'development / coding' (e.g. python) for GIS Officers / IT developers to bridge the gap between GIS and traditional IT development activities.

Outcomes – increase in availability and quality of spatial datasets (such as those that could be published as 'open data'). Provision of geospatial applications within the authority for internal/external use that would improve channel shift and the increased efficiencies around data management and processing (e.g. through spatial database warehousing).

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Access to Land Ownership causes the most problems and having a current, complete digital land ownership layer would be most beneficial internally. We have a mixed inventory consisting of paper maps (the standard) and a partially complete digitised version which cost over £100k. There is no further funding to capture and QA the rest.

We regularly carry out repairs and services on land we do not own. Because other key data such as Adopted Highway, and Grounds Maintenance are not updated (and not shared because of inferior quality) and the difficulty accessing ownership details makes what should be a simple query a protracted affair. However, in many cases this would breach SLA's service delivery times and therefore requests are completed without ascertaining if it's our responsibility.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The Gazetteer custodian should be made into a statutory role like SNN otherwise it's just not resourced correctly. Our team has continued to shrink - We have lost 4 Gazetteer Officers through redundancies, yet the Data Cooperation Standards increase annually. This affects data quality – we were Below Standard for 10 months in 2017 and are currently still below standard in 2018.

There should only be one master address dataset – need to merge PAF and Address Base (Gazetteer).

The 'full' Address should be open data – small business cannot afford to license addressing data.

This would provide more value and lend itself to an easier maintenance process for all concerned. I believe making Addressing open would be more beneficial than opening up MasterMap *per se*.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We make use of high resolution LIDAR data and this has helped to land successful bids in projects (e.g. identification of properties suitable for solar pv):

http://www.iscopeproject.net/

However, any data such as this which is current, complete and good quality is expensive to update. It would be useful if this could be incorporated into the APGB. The current offerings are adequate for basic land type applications but not really good enough for advanced analysis (e.g. 0.5m resolution and banded lidar (point clouds) in asl format). LIDAR, CIR and other remotely sensed products are often not that user friendly when rasterised and need vectorizing into something that becomes more useful for most GI users.

Procesing raster's requires specialist tools and these are expensive. Developing an open source raster API's, GIS toolset or improving existing tools (GRASS) and improving the open source libraries (e.g. GDAL) will help unlock potential in this area.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

One of the biggest issues in the Geospatial sector is the prohibitive cost of licensing. This makes growth and tech start-ups very difficult. It makes it hard to develop the business case based on R & D that requires some very expensive licensing to get started! It's not 'new' but the use of open source technology that can be shared has to be assessed. Many proprietary products use open source code beneath the bonnet (think FME, ArcGIS).

We have successfully run a mixed estate making use of GeoServer, PostGIS and QGIS desktop for the last five years. We have cut the ESRI product set to a minimum to reduce costs.

There needs to be some work done on the business models to help those companies to become sustainable. That said there a few companies around that provide implementation, support and development in open source GIS.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

It's the pyramid affect – we need to get the foundations in place with good quality core datasets, open source tools, open standards and the right skills. Once the foundations are built the higher end, more focused applications and technology can build on this and grow.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We see this happening already with merging of OS ITN with the NSG. This type of harmonisation is painful for all involved, but it's been a long time coming. Identifying and continuing to thrash out the differences between the major datasets being managed and maintained in different public-sector organisations will benefit all and make the higher end products and processes more achievable.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Most systems can now user a mixture of remote sensed positional information such as GPS, GLONASS etc. making for accurate locational information. The question is when is this not good enough and how can this be improved. Post processing is fine for asset inventory but it's no good for live on demand services where fixed sensors that have known points can send out coordinates, e. g. About to dig a hole into a mix of buried assets.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

A mandate to share data to help facilitate a fully-fledged buried assets layer of the Uk.

Some progress is being made for example a pilot being led up North: called the Northeast Underground Infrastructure Hub – a pilot to ship and clip buried assets on demand between utilities and Local Authorities to avoid strikes/damage to buried assets. Stakeholders include the DNO's Gas, Water, LA's and Broad band operators.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Around 80% of any GI project is spent on data preparation. The analysis and reporting are the easy bit. Access to Metadata in any standard would be useful but it's a rarity. – a data dictionary with a date is hard enough to maintain.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Land Registry data – but with all the additional attributes that are not currently supplied.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

We could ask you the same question!

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Good luck with that! You will have to implement something like INSPIRE and be prepared to provide funding. LA's are in a state of austerity – they won't deliver any additional burdens placed on them unless these are enshrined in law and funded.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Look at Google. They have shown the so-called GIS Experts such as ESRI and MapInfo a thing or two about tech. Who needs a business case to do things! If we build it, they will use 'IT' approach.

I would also say that 'spatial' is not 'special' – it's sometimes different. By making it 'special' you create the silo mentality. Oh, it's something about GIS; which is kind of missing the point. The 'G' needs to become mainstream. That's where it becomes useful. The 'where' tag is just one component of the 5W's https://en.wikipedia.org/wiki/Five_Ws

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

-

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Improved capability in geospatial data handling in the UK in future relies on an educated workforce with technical, engineering and scientific skills. The discipline of geomatics - surveying, mapping, earth observation, GIS, spatial analysis - has been greviously neglected in UK further and higher education for decades. Its importance has not been sufficiently recognised, courses have closed or been marginalised, the gap between ever-growing demands from industry for graduates in the field of geospatial data handling and ever-decreasing supply of well-trained and capable graduates is growing. The resultant 'de-skilling' leads to a vicious circle, of lack of knowledge of what is required and possible from such activity and a lack of appreciation of the level of skill required. There needs to be better direction from professional organisations and government, and more engagement from FE and HE.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

From the previous comment it might be imagined that promotion of 'geography' at school might be a solution. To me, that is, in fact, a difficulty. Geography is a nebulous subject, delivered to unfocussed students, who have little aptitude in technical aspects and little interest in developing a coherent and value-added core of knowledge and practical ability: it is a 'look-see' discipline, when what is needed is 'getting your hands dirty, and coming up with a deliverable' attitude. It would be more valuable to promote careers in the geospatial sector to engineers, badging 'geospatial engineering' as an activity equal to mechanical or civil engineering. The geospatial skills gaps are in measurement science and rigorous data capture, big data management, integration of technologies (soft- and hard-ware), and geostatistical analysis. The human angle is also required - policy-driven application of GI; study of human-computer interaction (notably for GI, in visualisation); community, infra-structure, and indeed disaster management all require geospatial skills.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

-

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

-

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

-

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

This list of new technologies is well-known. The geospatial industry is good at forecasting, but too often the predicted trends are taken on by other sectors, and geospatial finds it difficult to assert its contribution and promote its leadership. 'Driverless vehicles', for example, rely totally on geospatial data for operation, reaction, safety, economy and reliability. BIM drives a standard 'modus operandi' throughout construction, initially developed by geomatics and GIScience. Precision agriculture, 'smart cities', augmented reality, UAVs, location-based services are all exploitable technologies which geospatial must retain or regain control over. Even the insurance industry (pre-eminent in the UK financial services sector) could profitably employ more geospatial expertise, in both domestic and foreigh markets.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

-

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

-

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

-

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

-

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The legacy of available, publicly funded, accurate geospatial datasets has been severely damaged by political agendas in recent decades. The decision to disband the Soil Survey of England & Wales is but one example - the dataset is archived, no longer maintained and almost impossible to access. Agricultural censuses, weather data, property registers, election results data, public health information are either no longer systematic, commissioned on a 'one-off' basis, are expensive to access, or are restricted and non-transparent. Crime data is an example of a public sector dataset which is well presented and documented. Temporal and spatial comparability is important, for research and for practical usage of the data. The uncertainty about the operation and administration of the 2021 UK population census does not augur well for an effective, joined-up, government data management strategy.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

-

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

From a practical viewpoint, local councils need the resources to do this, rather than having their budgets relentlessly cut in the name of 'austerity'.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

-

Q18: Are there any other areas that we should look at as a priority?

-

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

-

Q20: How best can we make the UK's presence in the international geospatial world more visible?

UK expertise in the the global marketplace was, in the past, evident in the activities of a wide range of hi-tech (at the time) firms who supported both goverment (colonial) projects and capacity support for commercial activities overseas. The days of Hunting Surveys and Fairey Surveys, each with capacity for large integrated geospatial projects are long gone. The skills of DOS were set aside for many years when they integrated with OS several decades ago. The revival of OS International in recent years shows that the UK can still bid for large multi-disciplinary projects. If the UK private sector could be more collaborative then such large-scale capability could be marketed anew. The wide-ranging competencies of Norway's geospatial industry markets Norwegian expertise internationally under the banner of its GeoForum - 46 separate firms in a small country, offering integrated capability. Korea Sweden, Japan etc. also adopt such a collaborative approach to winning business overseas. The UK geospatial industry does itself no favours in valuing itself too cheaply, and being fragmented in outlook.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

see answer to Q20 above.

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Organisation	Newcastle University
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definition of 'positional data' is completely unclear. Some examples would help.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Skills are needed across all the sensing and positioning technologies (whether terrestrial, airborne, spaceborne or marine) that form the basis of geospatial data collection. This will require skills in fundamental mathematics and physics, and in various branches of engineering, and in aspects of the Earth, atmospheric and marine sciences which are needed to understand the full measurement problem. More should be done to engage practitioners in these fields and encourage migration into geospatial applications of their discplines.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We require skills in fundamental mathematics and physics, and in various branches of engineering, and in aspects of the Earth, atmospheric and marine sciences which are needed to understand the measurement problems faced in sensing and positioning technologies. Publicity and resources are needed to promote geospatial further education and careers to students of these subjects at 16+ (or earlier) and at university.
At present there is great difficulty in promoting the geospatial sector, because professionals in the sector are split amongst a wide variety of learned, professional and trade bodies (e.g. RICS, CICES, TSA, GA, RGS, IoN, RAS, GeolSoc, BCS). Although these bodies between them reflect the many aspects of geospatial data use, none of them represents the field as a whole, and this militates against a coherent high-profile effort to raise the profile of the discipline, to campaign for it, and to agree standards.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

No comment.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The information to translate between different address systems (including global and national coordinate reference frames) is a vital public good. The ability to use this without hindrance will be vital for developing geospatial applications.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

In technological terms, more targeted resources are needed for research and development in this area. This will include funding for satellite missions, whether through UKSA or as part of ESA (continued UK membership of ESA, post-Brexit, is important to achieve economies of scale in space missions). Development of an effective market must be based on stable availability of datasets, and/or a predictable transition from subsidised costs at early stages (and for research users) through to fully-commercial development where appropriate.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No comment.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No comment.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

These assets are an important public good, and their maintenance using public funds is a necessary support for the commercial geospatial sector, and a means of ensuring common (and exacting) adoption of standards.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Maintenance of GNSS reference station networks provides access to national and international reference frames which are vital geodetic infrastructure. Other positioning technologies (e.g. e-Loran, indoor positioning) are needed as backup and for particular environments. However, with the proliferation of GNSS satellites (space segments) there should be no question of diverting large amounts of resource towards a separate UK GNSS space segment.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

No comment.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

No comment.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By ensuring that all data, once obtained for the public, is available to the public.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comment.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Through the use of common data and metadata standards, regional strategies can be allowed to overlay or substitute aspects of a national strategy.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Again, the use of common data and metadata standards will allow common approaches to be applied to specific applications and datasets.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No comment.

Q18: Are there any other areas that we should look at as a priority?

No comment.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comment.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

As mentioned previously, at present there is great difficulty in promoting the UK geospatial sector because professionals in the sector are split amongst a wide variety of learned, professional and trade bodies (e.g. RICS, CICES, TSA, GA, RGS, IoN, RAS, GeolSoc, BCS). Although these bodies between them reflect the many aspects of geospatial data use, none of them represents the field as a whole, and this militates against a coherent high-profile effort to raise the profile of the discipline, to campaign for it, and to agree standards.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

UNGGIM.

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Data derived from the internet of things is specifically geolocated (or moving) but is often overlooked as spatial data as IoT is seen (incorrectly) as a computing science and technology issue. Place, space and location are embedded within how we conceptualise and use IoT data but not usually considered spatial data.

I would expand this list to include information that is currently not available but will be such as those being derived from CAVs and related infrastructure. The danger here is that it is corralled and ring fenced from public use by manufacturers and other (transportation industry) players.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There is a woeful lack of geospatial training at tertiary levels in the UK. We currently have very few instistitutions that develop analytical skills in geospatial measurement, management and analytics. (Compared with other countries and especially the emerging economies of India and China). I suspect there are less that 150 University trained Geospatial (at UG and MSc level).
There is a big skills gap between employment opportunities and availability of people to fill those opportunities from the technoloigy and digital sector all the way to oil and gas and construction.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We are in the privileged position of offering the only UK undergraduate course in Surveying and Mapping and GIS. Nevertheless addressing the skills shortage requires the embedding of spatial literacy within our schools curriculum and realising and championing the skills of geospatial analysts. They should be as ubiquitous as statisticians (and valued) but are not and there is a need to embed spatial thinking and problem solving (as well as practical data handling skills) into other disciplines.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Too many to mention. The moves to open data are a great step forward but it is a very complicated licensing, copyright and reuse landscape. Concerns here are more focussed on the private sector who consider spatial data as a monetary asset to be exploited through other services (Strava, Google, TomTom etc.). For use in such things as transport planning, urban analytics and simulation, access to geospatial data from non gov't sources is potentially key. Private data firms will be the key data holders in the near future (some already are). The move towards CAVs and other singularities (car on demand etc.) puts potentially critical datasets in the hands solely into private companies.

The issue is not just about data provision – mechanisms for timeliness of provision, upkeep and maintenance that all have a cost must be addressed. Ie. It is not enough to get a data dump as a one-off – it must be process based and ongoing. A key commitment to open-data through government contract and

licensing arrangements may be a way of passing the cost onto the operator and ensuring longer term solutions.

Mobile phone data could be a huge asset for research and planning.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Access is the key. Make it discoverable, visible and usable. Consider deploying data as services rather than files or products. Create SLAs for data delivery to encourage commercial use. Give open access to education and non commercial use to encourage training and understanding.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I don't think the emphasis should be on technology. It should be on methods for
1. data access
2. data provenance
3. commitment to openness
4. services rather than products
5. agility over completeness

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data (and the associated analytics) underpin many new technologies (AR, CAV, IoT to name a few) – they already implicitly are geospatial and interact with geospatial. They are not seen as geospatial problems and geospatial but technologies and data from the geospatial realm is absolutely there. The fact that we are asking this question is rather revealing as it assumes that geospatial is not ALREADY embedded. Therefore we need sustainable data delivery systems, pricing etc. to support it. These should be a revenue stream for better data and data integration from government data providers.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

1. Make it open and and ger revenue from innovation and growth in sectors that use it (hard to pin value and not market driven)
2. Be more agile in how data is delivered and charged for (and who gets charged)
3. The local authorities have a key role here (esp in urban data) but they have been stripped of skills (in Newcastle for instance the spatial team has gone from 8 people to 0.5 people over the past few years). Mapping and geospatial is not seen as essential.
4. Work with technology partners more directly as a key data provider

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Not my are of expertise but a national open GNSS correction facility would be useful.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

They already do, most don't share it though. Most of us use google services that effectively bypasses national data assets. Google (and others) are a useful delivery programme. If they are out of the loop they will develop alternate data sets (that may be inferior but will be widely used)

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

It's a very mixed bag. I really really don't think we should stress on standards – they are already there – but it needs variety as well as there are as many use cases for the data as there organisations using it. One size does not fit all. An agile approach with data being able to be accessed, queried and utilisied through many different lenses (quality, attributes, scale, function, location) is what we need. Technology moves so fast that principles and openness are more important than standards.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Provide leadership, vision and direction of travel. Use clout to enable access to data generated by commercial entities for the public good. Create a socio-technical ecosystem that enables data accessibility in an ongoing fashion. Be clear that today's solutions may not be applicable in 12 months time.

Invest in skills and develop these from the bottom up through from schools to universities and in the work place.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Mobile phone data – transport planning and analytics, fine scale movement patterns.
Data.gov.uk is a good start but clumsily executed for spatial data.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Encourage funding for spatial data specialists (data, analysis and visualisation) in regional and local government. They have been decimated.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Encourage funding for spatial data specialists (data, analysis and visualisation) in regional and local government. They have been decimated.

Have a pipeline of skilled practitioners to supprt

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

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- **natural resources**
- **sales and marketing**

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Q18: Are there any other areas that we should look at as a priority?

I think CAV is a game changer both in the quantity of data generated and required.
IoT – an inherently spatial issue that is not seen as such.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Data governance and data security is something that transcends sectors. IoT, CAV, Smart Cities are all dependent on the same set of technologies, protocols and semi standards.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Invest in the education sector. Ensure that it is seen as a profession with value.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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About you and your organisation

Name	[Text redacted]
Organisation	Northern Ireland Open Government Network
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Appreciation of the added value that openness, transparency and accountability, bring, as well as the capacity and involvement of citizens in the process. Regional coordination and balance, to avoid the mistake of piecemeal approaches adopted in the past leading to differences in service delivery and making inter-regional trade in expertise and service provision a challenge. A greater focus on what can be done with the data, rather than (solely) the existence and detail in the data itself.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In general, the availability and quality of open geospatial (and locational) data in **Northern Ireland is not on par with equivalent data across the UK.**

This acts as a **significant barrier to entry** for developers, business and end-users based in Northern Ireland or providing services to our citizens.

Governance of the Ordnance Survey Northern Ireland (OSNI) differs from that of OS in GB, and they have operated as separate entities since 1922. While OSGB is an *independent* non-ministerial government department with Executive Agency status, OSNI itself is simply a part of the NI Department of Finance's internal branch Land and Property Service (LPS). The Department of Finance therefore, in effect, has control over the availability and licensing of a number of strategically important geospatial datasets.

OSNI/LPS concerns about 'derived data' in turn **restricts the publication and licensing of other government departments' and public bodies' production of open geospatial and locational data**, even in cases where the impact would be insubstantial.

A National Geospatial Strategy must therefore be cognisant of the current **discrepancy in the availability, transparency and accountability of geospatial information assets in Northern Ireland**, and must seek to **address these limitations in a material way**, otherwise the economic opportunity that exists will not be delivered equally to all citizens.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

In particular, organisations and individuals in Northern Ireland are greatly disadvantaged by the **lack of a free, openly licensed postcode or address geolocation data,** seemingly due to a different funding situation with respect to Royal Mail's Postcode Address File. Use of the NI postcodes requires users to pay a substantial fee.

The fact is that it is not possible to perform a lookup operation on a postcode to determine a geographical location using well-maintained, purportedly accurate and official database under an Open Government Licence. This has **obvious and significant drawbacks** for the potential users and beneficiaries of this basic functionality as the licensing is not interoperable with, or on par with, the rest of the UK.

Access and positive impact could be greatly improved by **openly licensing the Northern Ireland Central Postcode Database**.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

See response Q4

We believe that there is a great deal of potential to be gained from openly-licensed spatial, geographic and property data which would bring significant economic and social value through the development of new products and services, innovative solutions to existing problems, and better access to information.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Adherence to open standards in procurement pipelines will lead to sustainable maintenance of assets without 'vendor lock-in', encouraging growth in specialised geospatial data processing SMEs.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Engagement with producers of national and regional (i.e. devolved) geospatial data assets in an open, transparent and participatory manner, and through contributing to the improvement of the quality of these assets.

Such engagement and participation should go beyond the immediate actors in the geospatial industry, and should also **involve citizens and organisations outside of the private sector**.

This engagement should occur **at a regional level, with local authorities and devolved administrations as well as the UK bodies**.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Previous response have highlighted the challenge of working with geospatial data in Northern Ireland on an equivalent basis to other areas in the UK.

Value could be better realised through **aiming to achieve parity across the UK** in the availability, openness and quality of geospatial data**.**

Interoperability of data licensing is as important an issue as technical interoperability for data users. As a general rule, licensing interoperability is best addressed through the **consistent adoption of the Open Government License** across all parts of the UK, and for as many types of spatial data as possible.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission can **identify regional imbalances which exist** due to either a differing approach or differences in need for particular geospatial data assets, and press for action to address the problems that this creates.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Comparative land registry and house price data is not accessible in Northern Ireland.

Cadastral data ('land packets') is also in short supply locally.

Land registry, domestic and non-domestic property data, including building types, size, valuation, land area, outbuildings, etc. both in tabular and GIS formats. This may form part of planning data held by other government departments.

Orthophotography. There are a number of historic orthophotographic datasets that are not the current version sold by OSNI as they have been produced in various waves (around 5) since 2006. Near-infrared imagery is also useful for quantifying vegetation coverage and health for agricultural and ecological purposes. While not commercially useful to OSNI, the historic photography from the older orthophotography could still be useful in a number of applications, particularly those with an interest in urban development, built heritage, environmental protection.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Previous responses have made reference to the challenge of working with geospatial data in Northern Ireland, and value could be better realised through **aiming to achieve parity across the UK** in the availability, openness and quality of geospatial data**.**

'Regional variations', in a national strategy context, should account for need, rather than being dependent on (and therefore restricted by) the ability or willingness of necessary parties to participate.

It is also relevant (and timely) to note that Northern Ireland faces significant challenges in its status and economic position due to Brexit, and that the somewhat lack of existence of innovative responses to these mounting problems, on the whole, **cannot be addressed by ignoring the areas in which the potential for developing new markets and solutions could be realised**.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

ANNEX II

Provisional Directory of UK Geospatial Short Courses

Acuity Training	MapInfo: Introduction
Austun Technology	iShare Administration iShare for Web Developers PostGIS Essentials PostGIS DBA Essentials QGIS Essentials QGIS Advanced QGIS Enterprise GeoServer Essentials GeoServer Advanced GeoServer Wizard Python Essentials Python for QGIS
BurdGIS	ArcGIS for Natural Resources An Introduction to GIS and QGIS
Cadline	Open Source GIS Integration Introduction to GeoServer Introduction to QGIS BIM Awareness for Managers BIM Awareness for Executives Introduction to BIM Project Management BIM Process for Building Services
Canterbury Christ Church University	Getting Started with GIS GIS for Ecologists
Clear Mapping Co.	Missing Maps Magic Map to QGIS Introduction to QGIS Confident Spatial Analysis, Vector in QGIS Confident Spatial Analysis, Raster in QGIS Introduction to using RStudio as a GIS Confident Spatial Analysis, Vector in RStudio Confident Spatial Analysis, Raster in RStudio
Cranfield University	Advanced GIS Spatial Data and the Internet Integrated River Basin Management Spatial Data Management Environmental Ecometrics Physical Principles of Remote Sensing
Esri UK	An Introduction to ArcGIS Pro for GIS Newcomers An Introduction to ArcGIS Pro for GIS Professionals ArcGIS Pro 2 - Essential Workflows for ArcGIS Pro ArcGIS Pro - Working with Model Builder Getting Started with LiDAR Data Network Analysis in ArcGIS Pro ArcGIS Pro: Working with 3D Analyst Extension Creating Python Scripts for ArcGIS Pro Creating and Editing Data with ArcGIS Pro ArcGIS 1 - Fundamentals of ArcGIS 10.x for Desktop ArcGIS 2 - Essentials of ArcGIS 10.x for Desktop ArcGIS 3 - Enhanced Skills for ArcGIS 10.x for Desktop Performing Analysis with ArcGIS for Desktop Introduction to ArcGIS 10.x for Desktop, for Healthcare Introduction to the Geodatabase 10.x Working with the ArcGIS ModelBuilder 10.x Working with CAD Data in ArcGIS for Desktop Editing in ArcGIS 10.x for Desktop Designing Maps with ArcGIS Getting Started with Python Scripting Language Introduction to Geoprocessing Scripts using Python 10.x Writing Advanced Scripts using Python Mastering ArcPy using Python for AarcGIS for Desktop 10.x CrimeAnalyst Extension for ArcGIS 10.x Working with Network Analyst 10.x Geoprocessing Raster Data using ArcGIS 10.x Spatial Analyst Working with 3D Using ArcGIS 10.x for Desktop 3D PathFinder: City Engine for Professionals Distributing Data using Geodatabase Replication
Esri UK (cont.)	Implementing Versioned Workflows in a Multiuser Deploying and Maintaining a Multiuser Geodatabase An Introduction to your ArcGIS Online Subscription Creating Web Applications using Web AppBuilder for ArcGIS Get Started with Insights for ArcGIS Creating Story Maps with ArcGIS Maps, Apps and a great UX ArcGIS Enterprise - Configuring a Base Deployment ArcGIS 4: Sharing Content on the Web ArcGIS for Server: Site Configuration and Administration 10.x Introduction to JavaScript Developing Web Apps with the ArcGIS API for JavaScript
Exegesis	QGIS: Foundation QGIS: Intermediate ArcGIS: Foundation ArcGIS: Intermediate MapInfo: MapBasic MapInfo: Foundation MapInfo: Intermediate CMSi: Foundation
Hertfordshire, University of	GIS: Introduction to Mapping & Analysis Transport Data; Collection and Analysis Environmental Management Tools and Methods
Imperial College London	GIS for Public Health
Institute of Historical Research	Historical Mapping and GIS
Institution of Civil Engineers	BIM for Asset Management BIM Implementation - Putting People First CDM2015 and BIM Digital Transformation - Implementation of a BIM strategy ICE BIM for Infrastructure
KOREC Group	Introduction to Topographic Survey Trimble TerraSync & Pathfinder Office K-Mobile and Custom System Configuration and Training Trimble Access for GNSS Based Survey Trimble Access for Total Station Based Survey Trimble Access – Roads Module GNSS Survey & Data Processing GNSS Site Calibration & Working to Scale Factor 1
Land Quality Management Ltd.	Getting Value from Your Data: a hands-on GIS course
Leeds Institute for Data Analytics	Introduction to GIS and Spatial Analysis for Retail Applications GIS for Crime Data Analytics Introduction to QGIS Spatial Modelling for Retail Analytics
London School of Hygiene and Tropical Medicine	GIS Basic Training
Lutra Consulting	QGIS Advanced QGIS Data Management in QGIS PostGIS GeoServer Automating Tasks with Python TUFLOW Modelling with QGIS
Newcastle University	GNSS and Network RTK High-Precision GNSS Using Post-Processing Least Squares Adjustment for Offshore Survey GIS for Teachers
OceanWise	Management Briefings on Data Management Marine Data Management Awareness Course Fundamentals of Marine Spatial Data Infrastructure (MSDI) Data Management and MSDI for Managers Data Management and MSDI for Practitioners

OceanWise (cont.)	Introduction to GIS using Cadcorp SIS
	Intermediate Use of GIS using Cadcorp SIS
	Introduction to Maritime Toolbar
	OceanWise Data Products
Oxford, University of	Introducing Mapping, Spatial Data and GIS
South Eastern Regional College	Geographical Information Systems
GeoData (University Of Southampton)	ArcGIS: Introductory
	ArcGIS: Advanced
	QGIS: Introductory
	QGIS: Advanced
	ArcGIS: Introduction to Coastal and Marine GIS
Thames Valley Environmental Records Centre	Introduction to GIS
thinkWhere	QGIS Beginner
	QGIS Advanced
	QGIS Analytical Skills
	QGIS Fast Track
	PostGIS User
	PostGIS Administrator
	Introduction to Drone Aerial Imaging
University College London	Urban Graphics 1: The City Footprint
	Urban Graphics 2: Urban Layers and Proposals
	Urban Graphics 3: Essential Urban Plans
	Urban Graphics 4: The City in 3D
	Urban Graphics 5: Introducing Urban Film and Photography
	Urban Graphics 6: Masterplanning in AutoCAD
	Urban Graphics 7: Urban Mapping in GIS
Urban Big Data Centre	Introduction to GIS using ArcGIS
Westcountry Rivers Trust	GIS for the Catchment-Based Approach: Introductory
	GIS for the Catchment-Based Approach: Advanced

ANNEX III

Provisional Directory of UK Geospatial Apprenticeship

ST0491	Geospatial Survey Technician (Level 3)
ST0221	Archaeological Technician (Level 3)
ST0492	Geospatial Mapping and Sciences (Level 6)
ST0772	Marine Surveyor (Level 6)
ST0577	Ecologist (Level 7)
ST0769	Archaeological Specialist (Level 7)

ANNEX IV

Provisional Directory of UK Geospatial Undergraduate Degree Programmes

Brighton, University of	BSc (Hons) Geography and Geoinformatics
East London, University of	BSc (Hons) Surveying and Mapping Sciences
Newcastle University	BSc (Hons) Geographic Information Science
	BSc (Hons) Surveying and Mapping Science
	MSci (Hons) Mapping and Spatial Data Science
Plymouth, University of	BSc (Hons) Ocean Exploration and Surveying
Swansea University	BSc (Hons) Geography and Geo-Informatics

ANNEX V

Provisional Directory of UK Geospatial Undergraduate Modules

	Level	
Aberdeen, University of	5	Mapping and Monitoring the Environment
	6	Remote Sensing and Geographical Information Systems
Aberystwyth University	5	Analysis and Presentation of Geographical Data
	6	Geographical Information Systems
Bangor University	5	GIS and Research Methods
	5	Earth and Ocean Observation
	6	Catchment Modelling and Analysis
	6	Advanced GIS and Remote Sensing
Birkbeck, University of London	4	Introduction to Spatial Thinking
	5	Principles of Geographic Information Systems
	6	Advanced Applications of GIS
Birmingham, University of	4	Mapping the Midlands
	5	Geomatics
	6	Remote Sensing of the Cryosphere
	6	Geological Mapping Project
Bishop Grosseteste University	4	Data, GIS and Spatial Analysis: Cultural and Historical Change
	5	GIS: Investigating Society
	6	Advanced GIS: Investigations and Explorations
Brighton, University of	5	GIS and Remote Sensing: Principles and Practice
	6	Advanced GIS and Remote Sensing
	4	Land and Construction Surveying
	4	Statistical and Spatial Data Analysis
Bristol, University of	5	Spatial Modelling
Brunel University	4	Research Skills, GIS and Fieldwork I
	5	Research Skills, GIS and Fieldwork II
	6	Fundamentals of Geotechnical Engineering and Surveying
Canterbury Christ Church University	4	Basic Cartography and GIS
	5	Geographic Information Science and Visualization
	6	GIS and Remote Sensing for Environmental Management
Central Lancashire, University of	5	Geographic Information Science
Chester, University of	6	Remote Sensing and GIS
Coventry University	4	Numerical and Spatial Skills for Geography
	5	Applied GIS and Remote Sensing
	6	Advanced Geoinformation
Cumbria, University of	5	Geographical Information Systems
	6	Advanced GIS and Remote Sensing
Derby, University of	4	Cartography and Mapping
	5	Introduction to Remote Sensing and GIS
	6	Applied GIS
	6	Terrain Evaluation
East Anglia, University of	5	GIS for Project Work
East London, University of	4	GIS & Mapping
	5	GNSS and Coordinate Reference Systems
	5	Data Acquisition and 3D Modelling
	5	Engineering Surveying
	6	Surveying Project Design and Implementation
	6	Management and Professional Studies in Geomatics
	6	Sea Surveying
	6	Cadastre and Land Management
Manchester Metropolitan University/ University of Salford		Applied Geographical Information Systems (UNIGIS)
		Geographical Information Systems (UNIGIS)
Manchester, University of		Geographical Information Science
		Environmental Monitoring and Modelling and Reconstruction
Middlesex University		Building Information Modelling Management
Newcastle University		Geomatics (Research)
		Geomatics
		Spatial Planning
		Regional Development and Spatial Planning
		Regional Development and Spatial Planning
		Flood Risk Management
		Hydroinformatics and Water Management (Euro Aquae)
Nottingham, University of		Engineering Surveying with Geographical Information Science
		Engineering Surveying and Geodesy
		Environmental Management and Earth Observation
Oxford Brookes University		Spatial Planning
		Spatial Planning Studies
		Building Information Modelling and Management
Portsmouth, University of		Geographical Information Systems
Queens University Belfast		Building Information Modelling Project Management
Reading, University of		Spatial Planning and Development or Research
Sheffield Hallam University		Geographical Information Systems
Sheffield, University of		Applied Geographical Information Systems
South Wales, University of		Wildlife and Conservation Management
Southampton, University of		Applied Geographical Information Systems and Remote Sensing
Strathclyde, University of		Hydrogeology
Swansea University		Geographic Information and Climate Change
University College London		Advanced Spatial Analysis and Visualisation (Research)
		Civil Engineering (with Geographic Information Science)
		Geographical Information Science
		Geoinformatics for Building Information Modelling
		Geospatial Analysis
		Smart Cities and Urban Analytics
Ulster University		Environmental Management and Geographic Information Systems (E-Learning)
		Environmental Management with Geographic Information Systems (E-Learning)
		Geographic Information Systems (E-Learning)
		Geographic Information Systems (E-Learning)
		Marine Spatial Planning (E-Learning)
		Marine Spatial Planning (E-Learning)
UWE Bristol		Building Information Modelling in Design Construction and Operations
Warwick, University of		Urban Informatics and Analytics
Wolverhampton, University of		Building Information Modelling
		Building Information Modelling for Integrated Construction

The Royal Geographical Society (with IBG) is the UK's learned society and professional body for geography. Founded in 1830, we are a world centre for geography supporting research, education, expeditions and fieldwork, and informed enjoyment of our world. **W** www.rgs.org [Text redacted]

ANNEX IV

Provisional Directory of UK Geospatial Master's Degree Programmes

Reading, University of	5	Spatial Data in the Digital Age
	5	Monitoring the Earth from Space
	6	Environmental Modelling
	6	Modelling of Marine Ecosystems
Royal Holloway, University of London	5	Digital Geographies: Introduction to Remote Sensing and GIS
	6	Geographical Techniques II
	6	Critical GIS
Salford, University of	5	Geographical Information Systems and Science
	6	Modelling Environmental Systems
	6	Environmental Remote Sensing
Sheffield Hallam University	5	Geographical Information Systems
	6	Advanced GIS
Sheffield, University of	5	Geographic Information Systems and Remote Sensing
	5	Geographical Data in the World
	6	Advanced Geospatial Analysis
South Wales, University of	4	Introduction to Data Analysis and GIS
	5	Techniques in Geography
	5	Digital Mapping for Geology
	6	Earth Observation
Southampton, University of	5	Introductory Geographic Information Systems
	5	Advanced Geographic Information Systems
	6	Applied GIS: Using GIS in the Workplace
Sparsholt University Centre	5	Landscape Ecology and GIS
St Andrews, University of	6	Geological Mapping
	6	Advanced Geological Mapping
	6	Field Excursion and Map Interpretation
	6	Applied Geological Mapping
	6	3D Geological Mapping
	6	Introduction to Geographic Information Science
	6	Geographic Information Systems for Environmental Management
	6	Spatial Processes
	6	Advanced Topics in Geographic Information
Stirling, University of	6	Geographical Information Systems
Swansea University	5	Introduction to Geographic Information Systems
	5	Urban Modelling
	5	The Earth from Space: Monitoring Global Environmental Change
	6	Spatial modelling and monitoring of plant species distribution and functional traits
University College London	5	Environmental Remote Sensing
	5	Geocomputation
Ulster University	5	Remote Sensing and Geographical Information Systems
	6	Seafloor Mapping
	6	Advanced Geographic Information Systems
UWE Bristol	6	GIS and Remote Sensing Applications
Winchester, University of	4	Exploring Geographical Data
	5	Geographical Information Systems
Worcester, University of	5	GIS
	6	Applied GIS and Remote Sensing
York St John University	4	Mapping the Geographies of Yorkshire
	6	Applied GIS
York, University of	5	Geographical Information Systems

Aberdeen, University of	Geographical Information Systems
Aberystwyth University	Remote Sensing and Geographical Information Systems
Birkbeck, University of London	Geographic Information Science
	Information Systems and Management
Brighton, University of	Geographical Information Systems and Environmental Management
Bristol, University of	Environmental Policy and Management
Canterbury Christ Church University	Geospatial Analysis
	Cartography and Infographics
Cardiff University	Building and Infrastructure Information Modelling for Smart Engineering
Cranfield University	Geographical Information Management
	Defence Simulation and Modelling
Derby, University of	Building Information Modelling and Project Collaboration
Dundee, University of	Spatial Planning with Environmental Assessment
	Spatial Planning with Urban Conservation
	Spatial Planning with Sustainable Urban Design
	Renewable Energy and Environmental Modelling
East Anglia, University of	Environmental Sciences (Research)
East London, University of	Computer Science
Edinburgh, University of	Earth Observation and Geoinformation Management
	Geographical Information Science
	GIS (Research)
	GIS and Archaeology
	Sustainable Resource Management
Glasgow, University of	Spatial Planning
	Geoinformation Technology and Cartography
	Geomatics and Management
	Geospatial and Mapping Sciences
Greenwich, University of	Spatial Data Science
King's College London	Environmental Monitoring, Modelling and Management
	Urban Informatics
Kingston University	Geographical Information Systems and Science
	Hazards and Disaster Management
Leeds, University of (with University of Southampton)	Geographical Information Systems (distance learning)
Leeds, University of	Geographical Information Systems
	River Basin Dynamics and Management with Geographical Information Systems
Leicester, University of	Geographical Information Science
	Geographical Information Science (with Industrial Placement)
	Environmental Informatics
Liverpool John Moores	Coastal Resilience
Liverpool, University of	Geographic Data Science

Edge Hill University	5	Digital Geographies
	6	Remote Sensing
	6	Applied Geographical Information Systems
	6	GIS Solutions for Hazard Management
Edinburgh, University of	6	Principles of Geographic Information Science
	6	Remote Sensing and Global Climate Change
Glasgow, University of	6	Cartographic Design Option
	6	GIS A: Applied Spatial Analysis
	6	GIS B: Theory and Practice
	6	Geovisualisation: Design and Use of Maps
	6	Remote Sensing
Gloucestershire, University of	5	Geographic Information Systems
	6	Advanced Geographic Information Systems
Greenwich, University of	5	Introduction to Geographic Information Systems
Harper Adams University	6	Geographical Information Systems and Land Use
Heriot-Watt University	4	Statistics, Data Analysis and GIS
	5	Surveying and Monitoring in the Built and Natural Environment
	6	Remote Sensing of Environments
Hertfordshire, University of	5	Fundamentals of Geospatial Information
	6	Implementing Geospatial Information
Highlands and Islands, University of the	6	GIS and Remote Sensing
Huddersfield, University of	5	Spatial Modelling
Hull, University of	6	Geotechnologies A: Advanced GIS
	6	Geotechnologies B: Environmental Modelling
	4	3D Earth: Geological Maps and Structures
Keele University	6	Applied GIS
King's College London	5	Geocomputation
	5	Spatial Analysis
	5	Environmental Remote Sensing
	6	Environmental Remote Sensing II
	6	Applied Geocomputation and Spatial Analysis
Kingston University	4	Digital Earth and Spatial Analysis
	5	Cartography, Remote Sensing and Spatial Analysis
	6	GIS Transforming Geography and Environment
Leeds, University of	6	Hydrological Monitoring and Modelling
	6	Geocomputation and Location Analysis
Leicester, University of	5	Geographical Data Analysis
	5	Remote Sensing for Geographers
	5	Geographical Information Science
	5	Geomatics for Geographers
	6	Critical Digital Geographies
	6	Remote Sensing for Geographers (2)
	6	Geographical Information Science (2)
	6	Information Visualisation
Lincoln, University of	4	Earth Observation and GIS
	5	Earth Observation, Modelling & Visualisation: Representing Reality & Understanding Change
	6	Advanced Earth Observation GIS
Liverpool Hope University	4	Field-based investigations
	5	Landscape Investigation and Interpretation, Geospatial Data Analysis and GIS
Liverpool John Moores University	5	GIS, Geography and Beyond
	6	Environmental Modelling and GIS
Liverpool, University of	4	Study Skills and GIS
	4	Study Skills and GIS (Earth Science)
	5	GIS for Human Geography
	5	Field Mapping Techniques
	6	Geographic Data Science

Loughborough University	4	Cartography, Digital Mapping and GIS
	5	Remote Sensing and GIS
	6	GIS Modelling and Flood Risk Management
Manchester Metropolitan University	4	Introducing Geographical Information Science
	5	GIS and the Workplace
	6	Environmental Remote Sensing and GIS
	6	GIS in the City
Newcastle University	4	Geographic Information Systems
	4	Principles of Remote Sensing
	4	Mapping Fieldcourse
	4	Surveying
	4	An Introduction to GNSS and its Applications
	4	Quantitative Methods for Geomatics
	4	Tutorial Study Skills for Geomatics
	4	Informatics 1
	5	Observation Processing and Analysis
	5	Geographic Information Systems: Theory and Application
	5	Map Projections and Geodetic Datums
	5	Photgrammetry and Laser Scanning 1
	5	Applied Remote Sensing and Image Processing
	5	Geomatics Practice and Research
	5	Spatial Data Modelling and BIM
	5	Informatics 2
	5	Digital Data Acquisition
	6	Mapping the city: the urban form, transformation, and experience
	6	Advanced GIS Fieldcourse
	6	Professional Practice
	6	Photogrammetry and Laser Scanning 2
	6	Geohazards and Deformation of the Earth
	6	Geospatial Informatics
	6	GNSS Theory and Practice
	6	Offshore Survey
Northampton, University of	4	Geographical Techniques 1
	5	Geographical Techniques 2
Northumbria University	4	Exploring Geographical and Environmental Data
	5	Earth Observation and GIS
	6	Modelling, Computation and Data Manipulation
	6	Advanced Geospatial Applications
	6	Geophotography
Nottingham Trent University	5	Geographical Information Systems and Spatial Analysis
	6	Applications of Remote Sensing
Nottingham, University of	4	Introduction to Geographic Information Systems
	5	Digital Explorers: Finding Geospatial Patterns in a Changing World
	6	Environmental Informatics and Modelling
	6	Geospatial Technologies: Mobile, Augmented and Virtual
Oxford Brookes University	5	Geographical Information Systems
Plymouth Marjon University	6	Forensic Geographic Information Systems (GIS)
Plymouth, University of	4	Mapping the Marine Environment
	5	Seafloor Mapping
	5	Marine Remote Sensing
Portsmouth, University of	5	Mapping and Modelling Our World
	5	Geological Remote Sensing and GIS
	6	GIS in the Workplace
	6	Databases for GIS
Queen Mary, University of London	5	Geospatial Science
	6	Terrestrial Vegetation Modelling
	6	Advanced GIS
Queen's University, Belfast	5	Maps and Mapping
	6	Advanced GIS
	6	Geoforensics

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	North Somerset Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Nothing to add

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Nothing to add

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Make senior managers and decision makers aware of the existence and benefits to the organisation of spatial data. As a result of this hopefully further resources will be allocated towards the development of geospatial data and staff can be given the opportunity to stay up to date with changes in the industry and develop their skills (for example obtaining CGeogGI status). At the moment there is no time and little money/budget to obtain these credentials.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Currently the council has to pay for access to British Geological Survey data. Our Flooding Team uses this data in order to assess flooding risks. It would be helpful if we could receive this data free of charge.

It would be helpful if we could get access to Land Registry data as this would enable us to more quickly find out ownership information which would enable large council infrastructure projects to progress faster and more efficiently. At the moment we have to pay for these searches, but it would be even better if we could access this data free of charge.

In terms of street naming and numbering allocations it would be useful to be able to interrogate the MPAN database in order to check for any duplicate numbers/property names prior to allocating new addresses. At the moment this address information is unobtainable.

Satellite navigation systems and certain private mapping providers such as Google do not consult with Local Authorities with regards to road types and road names. A recent example of this is the naming of a new bus link road which Google have added to their map as Feeder Road when the official name is Longmoor Way. There is no easy and quick way to make Google aware of these errors which is frustrating. Also, in terms of Highways data Feeder Road which is accessible to buses and emergency vehicles only was listed as open to local traffic, buses, towed caravans, trailers and motorhomes on Here maps' database. We need improved channels of communication with these private organisations so that the data that they hold is always accurate. Inaccurate third party content causes additional issues for Local Authorities in terms of increased queries and resolving otherwise unavoidable issues. Google especially seem to decide whether they want to accept my suggested modifications leaving incorrect data in the public domain for as long as they wish.

The e-PIMS website is a good idea however the data could be up to six months out of date which means that it is unusable. The data is represented by points and not polygons therefore the information that is there is not only potentially out of date but not very meaningful either. Please can this website be improved as it has a lot of potential.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The UPRN and BLPU need to be made freely available along with its various LPIs e.g. approved address, alternative address, historic address. Current licensing issues stops us from making this information available and therefore the wider public and third party private sector companies are not aware of its existence.

Street naming and numbering requires new, clear legislation which especially clarifies whether councils can charge for the provision of the service and how the address allocation process should take place. It also needs to be made clearer that Local Authorities issue addresses and it is not the property owner's duty to allocate their own version of the address. Unofficial addresses cause issues going forward in terms of them not being listed on external databases, future tenants experiencing issues with their credit rating etc. Unofficially allocated addresses often become embedded and therefore changing them at a later stage can often generate more confusion and hence this cannot be done.

The ownership of the postcode by Royal Mail causes issues. Also, the way in which postcodes are being used today is not what they were designed for e.g. using postcodes in sat navs. An alternative to postcodes needs to be developed which is more fit for purpose and means that addresses will be free from any Royal Mail copyright issues.

Local Authorities experience issues with the fact that the public are more likely to see Royal Mail's version of their address than the council's. Because of this the

public believe that the council's version of their address is incorrect. One of the biggest anomalies between the two datasets (council and Royal Mail) are that the council's version of the address must refer to a street, however especially in rural areas Royal Mail don't refer to streets and instead refer to localities. The council's addresses are geographical whereas Royal Mail's are for the delivery of mail.

The link to Royal Mail and the power that they hold over how addresses are shown on their database (e.g. the multi occupancy database and alternative records) is especially restrictive to Local Authorities and also creates confusion for the public.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

If the UK is to lose access to Copernicus data from the EU, we should start looking into a replacement or find a way to remain a part of the Copernicus program.

Examples of data currently provided by Copernicus that are useful for UK economic growth (by informing decisions) are optical land imagery (for emergency services), atmospheric data such as weather, infrared imagery and other land data such as nitrogen saturation (for food production/growth predictions and monitoring) and altimetry (for development of land and navigation).

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Drones, autonomous vehicles

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Using the UPRN as a unique identifying feature. ESU points/lines used as an aid to navigation for autonomous vehicles.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Subject to support being offered and an acceptable timescale being in place it would benefit others if all Local Authorities worked to a standard dataset format for key datasets such as highways and street lights. Therefore, if for example Highways England needed to combine all Local Authorities Highways datasets this could be easily achieved.

Provide better awareness and funding of geospatial departments so that time can be invested in streamlining procedures and creating efficiencies rather than just processing data as per business as usual.

Better funding would enable Local Authorities to purchase new technologies or attend courses where staff would glean better skills to enhance the maintenance and improvement of our geospatial data.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Nothing to add

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Make data sharing easier between public and private organisations. At the moment sharing data which has been derived from Ordnance Survey data or which contains a UPRN or any reference to PAF is difficult. The private sector should make data sharing easier.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Subject to support being offered and an acceptable timescale being put in place it would benefit others if all Local Authorities worked to a standard dataset format for key datasets such as highways and street lights. Therefore, if for example Highways England needed to combine all Local Authorities Highways datasets this could be more easily achieved.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Nothing to add

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Please refer to question 4

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Nothing to add

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Maintain annual, free PSMA and Geoplace conferences

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Nothing to add

Q18: Are there any other areas that we should look at as a priority?

Nothing to add

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Drones, autonomous vehicles

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Better communication and marketing

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Nothing to add

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	North Yorkshire Police
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Emergency Service**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Ensuring that Geo Standards used are as open as possible. Avoid proprietary formats whenever possible.

Providing a repository for National Datasets that are updated by the relevant Single Source of Truth centrally and available to all.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Ensure UK has access to Satellite Navigation System.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Within Policing, whilst everyone understands the need for effective mapping and gazatteer products, there is little understanding of how the functions are deliverd and maintained. The common (but annoying) expression of, “It’s just an address.” is often heard.

The College of Policing and Police Officer/PCSO training should include at least a dedicated section on addressing and mapping and specialist training should then include extra training on available technologies.

Education should start at Primary School level regarding Geo.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Phone box information is provided by BT when requested, however this is only on request. If this information was available to download at any time, with a defined update cycle, it would benefit all.

Road speed information, there is a large gap between the accuracy of posted speed limit signs and the legal document that defines the start and end of speed limit variations.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

If Standards are introduced that incorporate the main elements of Geo referencing, and addressing then it becomes easier for the data to be consumed in a consistent way.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Ensure Galleleo or similar is available.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Do not focus on technologies, focus on data standards that will allow the data to be exploited by those technologies.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Allowing the most open policies to give free reign to individuals to innovate and develop systems and applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Resources (both human and financial) are required.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The ones that have the support of industry.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As most innovation comes from the private sector, they should be involved.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The recent introduction of Imagery into the PSMA has had an incredibly positive effect. This dataset was previously prohibitively expensive for our organisation to justify as most of the benefits are very hard to financially quantify.

The continued IP and copyright issues of both Postcodes and UPRN with Eastings/Northings inhibits the wider adoption of the UPRN as a referencing key.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By acting as single procurement agency.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

3D cities.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

By defining standards that take into account the regional variations. IE '2nd Language' fields.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

This probably relies on effective resourcing, but also increased access to data requires that there are effective mechanisms to keep the data current. Each data set should have a clearly defined schema to accommodate additions, amendments and deletions.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Infrastructure to include Roads and the information to deliver smart vehicles and smart cities.

Q18: Are there any other areas that we should look at as a priority?

The opening up of geospatial data will expose the data to a greater critical audience. There should be an avenue by which users of the data can feed back errors & omissions in a timely manner and these should be acted upon to increase the currency, accuracy and detail of the geospatial data.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Smart Roads, Smart Cities.
Citizen centric service delivery.

Update of the archaic SNN legislation and include a much more robust enforcement of prominent building number display.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	University of Nottingham
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We include all spatially organised data within this definition; coming from satellites, aircraft, drones, sensors on the ground and in the sea, probes in the atmosphere, data related to satellite positioning and navigation and all data collected using the full range of surveying techniques, including crowd sourcing, as well as data that is put together using various techniques that can be grouped under the heading GIS.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In the light of Brexit and UK national security we should ensure UK academia is well resourced and well funded to provide people with the Geospatial skills for the future, including GNSS and specialised Earth Observation, such as novel InSAR techniques originating in the UK like ISBAS, as well as a good understanding of the many application areas that geospatial data can service.

The teaching of these undergraduate and postgraduate students should also be complemented by the promotion, provision and full professional accreditation of Continuing Professional Development courses.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a shortage of, for example, homegrown GNSS and InSAR specialists in particular. These technologies should be promoted much more effectively through STEM ambassadors and careers events.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Public procurement of novel datasets such as the UK relative land deformation map produced using the ISBAS processing technique from Geomatic Ventures Limited should be considered. Once established, underpinning of the ongoing updating of the dataset on for example a biennial basis, with managed access to UK public sector organisations, would be beneficial.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We have no comment on this question.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Development of an integrated UK InSAR capability should be considered; we have several leading groups and at least three specialised companies but they operate individually and we do not realise their full potential.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

We need to turn to Artificial Intelligence and machine learning to handle the data volumes and provide rapid but accurate analyses in near real time.

There are big opportunities to apply geospatial technologies and generate growth in infrastructure, logistics and distribution networks, where such data are currently under exploited. These issues are of particular importance in the East Midlands, a distribution hub. Applications to, for example, new rail infrastructure such as HS2 are ripe to be developed. Other areas where this applies are agriculture and food production.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

One of the key future technologies is Artificial Intelligence. Geospatial data are the petrol in the engine of AI. Greater efforts should be made to connect the two.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Government should continue to follow the current free and open data policy and avoid charging for data wherever possible.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Enhanced multi-GNSS and 5G enabled Network RTK infrastructure across the UK. A UK controlled and managed equivalent of the EU PRS system.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector is well-placed to provide contributions to both infrastructure and data through public procurement contracts.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Not all major data sets are subject to the free and open data policy. Work should continue to bring as many national datasets as possible under its influence.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It can actively engage with and promote the use of the data arising from new UK technological breakthroughs such as the ISBAS InSAR processing method.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Efforts should be made to secure access to UK 3D terrain data from a variety of public and private sources.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

This requires a national conversation. Ensure that regional representatives are engaged in that process, from across the regional industrial, academic and public sector. Allow plenty of time for it to take place; it should not be rushed.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

We have no comment on this question.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

InSAR ISBAS processing of satellite SAR data to extract ground motion over all land cover types, invented by the University of Nottingham and since developed and exploited through Geomatic Ventures Limited, is a real example of a cutting edge technology that could be leveraged and scaled up to provide new insights for property land, infrastructure, construction and natural resources monitoring.

Q18: Are there any other areas that we should look at as a priority?

Navigation and positioning in challenging areas: indoors, or in urban and rural settings, especially in relation to autonomous vehicles.

Applications in agriculture, forestry and urban planning.

Use of Earth Observation in policy & practice – we need to get it used more for environmental management applications and in direct support of major policies.

Finally, we need to grow its role in managing the subsurface. Decisions on the use of the ground beneath our get are ever more important and EO can play a role in improving them.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Where there are environmental risks identified and a lot of public scrutiny, the regulators should be encouraged through legislation to take full account of new technologies for identifying environmental factors. As an example, the ISBAS InSAR processing method is the only technology that provides actual values of land motion over all classes of land cover. This technology could be harnassed to monitor land motion caused by industries that have the potential to affect surface motion in the UK e.g. mining, onshore oil and gas, fracking, flood defences, large infrastructure projects and other installations (e.g. HS2, smart motorways & smart cities) etc.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Create an active programme for promoting international geospatial trade and inward investment. Encourage and incentivise geospatial champions from many different industries, academic institutions and the regions representing specific technological areas. Actively promote leading edge, emerging technologies that represent the best of British through the Geospatial Commision e.g. ISBAS InSAR processing.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Germany, Netherlands, Australia.

We should also watch closely what is done in the USA, although the conditions there are very different to those in the UK.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	NYFKO Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

In our opinion three data types would be sufficient, as the Geospatial Identifiers could be fit into Geospatial Data and Positional Data.

We think the type of real-time geospatial data is missing, e.g. traffic information, weather radar data, etc.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Assisting and providing support for start-ups in the geospatial sector to ensure UK companies can bring their ideas from the whiteboard to a functioning geospatial business model.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Clean datasets can help in future to promote machine learning on those geospatial datasets, therefore knowledge of computer science is essential. Currently the geospatial data sector is lacking main stream data science skills having courses that promote combining main stream data science skills with geospatial skills would be benefitial.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Hydrographic office's S-57 data would be benefitial, as well as any kind of elevation datasets from OS, UKHO, BGS, Crown Estate, licensing blocks datasets, BGS geochronological and resource datasets etc.

In lot of the cases, value value added services or products are created by by combining various datasets hence having easy access (if not open access) is crucial to building value added services and products.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The coverage areas of postcodes could be refined (insurances screening, etc…)

Currently utilities, insurance, bank and other service providers use postcode to profile risk and availability of their services. A post code might cover quite large geographical area. As more granular data becomes commonplace, all those providers would be encouraged to provide further tailored products and it will also see more competitive offerings. Hence we believe further granularity is needed in address data system.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Try to keep affiliation with EU space agency to ensure full access to high quality earth observation data sets such Sentinel, Galileo, etc…

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Big data science and machine learning are key technologies which will benefit the growth of the geospatial economy significantly.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

As Internet of Things, Selfdriving cars, drones becomes common technologies in the near future they all will require detailed understaning of geospatial features. Hence it is important that the geospatial sector is prepared to support future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Working with private organisations to develop derived data products from public sector datasets
- Free for development access to data held currently by government organisations
-

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Finer resolution satellite images than Sentinel datasets (up to 1m), free Lidar data,

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Quite a significant role, otherwise key new developments will be missed and the provided datasets will be insufficient. Also the technological development have to keep up to date to prevent falling into a reactive role in the development of geospatial roles.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The largest improvement would be to standardize the way lat, longs are being published. If all lat longs could be displayed in decimal degrees that would make it much easier for all datasets to be implemented on the fly without the need of time intensive transformations.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

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Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

The following datasets would be benifitial to have full access to for the public to be able to develop more and innovative geospatial solutions:

-Crown Estate licensing blocks datasets
- BGS geochronological and resource datasets

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Establish proper channels for communication between geovernmentr bodies, academia and industry. Ideally set up a mixed advisory board having at least two meetings per year.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Inmproved communication and make sure laws are in place clarifying the proper use of geospatial data, which are clear and enables the most efficient and appropriate use of such data.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The evoloving sector of proptech (property technology) needs to be scaled up and get supported by the provision of clean and sufficient data by the authorities. As part of the ongoing digitization and the use of machine learning the insights which can be gained by the use of geospatial data for proptech is limitless and will change the world we are acquiring property and land, as wel as in construction and natural resources. The provision of clean, standardized geospatial datasets are key in those sectors to generate unique and worl leading tools to asses these resources in a fast and efficient way.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

See reoky in Q17. One regulatory challenge may be the use of address and telpohone information for individuals. Some limitations in privacy protection can hinder and slowdown some planned developments. In those field countries which do not have those regulations in place have a competitive advantage to the UK. Leaving the EU could give the UK more flexibility to adjust those laws, free from EU regulations and help to make the UK become more competitive in such areas.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

See Q20.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	OceanWise Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**

Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Generally, yes, however, we would also like to make the distinction between geospatial data that is in different 'states', recognising the value chain of data from raw data through to information in the form of data products and services. We believe that in the marine sector particularly, there is a complex picture of differing states of data, with much data available in its product state (e.g. navigational charts), which is not fit for other purposes, or in its raw state (e.g. individual hydrographic surveys), which requires significant value to be added prior to use.

Product-based data is designed and maintained for a particular purpose e.g. navigation and hence is unsuitable for wider use, being misleading with often associated safety and commercial risks. For example, navigational charts include only wrecks that are a danger to surface vessels, being around 20% of the known wrecks; for many non-navigational applications it is important to know about all wrecks. Considerable rework of navigational data is required to make it suitable for wider use including augmented navigational data with source data.

Raw or partially processed datasets may require significant expertise and effort in order to create products and services that are suitable to most end users. For example, OceanWise has processed many thousands of hydrographic survey datasets, including digitizing around 1000 paper survey sheets (known as fairsheets), comprising many billions of soundings to create a seamless Digital Elevation Model (DEM) of the UK Continental Shelf. The DEM is available at

different levels of resolution and is part of OceanWise's suite of marine mapping products and services that have been developed specifically for wider use e.g. in desktop and web GIS. A low-resolution version of the DEM is supplied to EMODnet, as part of the UK's commitment to create an Atlas of European Seas.

OceanWise marine mapping products and services are used widely across the public and private sectors in the U.K. and overseas. OceanWise has framework agreements with the Welsh, Scottish and Northern Irish Governments, and makes its data available to higher and further education via the Marine 'Digimap' service. The data is also used widely across the oil and gas, renewable energy, aquaculture, telecommunications and other sectors.

OceanWise personnel have been promoting wider and appropriate access to marine data for use in GIS and similar systems for over 20 years. Their efforts resulted in the first re-use licence agreement with the UK Hydrographic Office (UKHO) in 1998, the setting up of SeaZone Solutions Ltd as a wholly owned subsidiary of Admiralty Holdings Ltd. in 2005, and the establishment of OceanWise in 2010.

During this period, OceanWise personnel have championed marine mapping for wider purposes, rather than charting which is purely for navigation, for over 15 years, gaining much traction and bringing business back to the U.K. over this period. This success was aided by the creation of the Marine Spatial Data Infrastructure (MSDI) Working Group within the International Hydrographic Organisation (IHO) in 2006.

Made up primarily of national Hydrographic Office personnel, the MSDI Working Group has helped transform the way hydrographic offices now consider data. OceanWise continues to be an expert contributor to the working group, acts as its secretariat, and undertakes training on behalf of the IHO on this increasingly important topic.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There is a general focus across the sector on the use of GIS and similar technologies. There has been far less investment in the management and governance of data, leading to a lack of skills and understanding of this fundamental requirement. Geospatial data and its governance can be considered as data science, and as such should be a core requirement for anyone working in the geospatial sector. Sadly, this is often overlooked.

In recognition of the above, OceanWise is a member of the International Data Management Association (DAMA) and undertakes marine data management training via the International Hydrographic Organisation (IHO), as part of its capacity building programme, and directly to national Hydrographic Offices and Regional Hydrographic Commissions globally. OceanWise also collaborates with the Institute of Marine Science, Engineering and Technology (IMarEST) providing data management awareness training as open courses or to individual organisations. This training is backed up with ongoing advice and mentoring.

OceanWise is active in the Marine Environmental Data and Information Network (MEDIN) since its inception in 1999 (although the name has changed). Currently, OceanWise is MEDIN's only industrial sponsor, its personnel sit on MEDIN's Executive Team and working groups and represent MEDIN on certain working within government (e.g. the Marine Industries Liaison Group; MILG).

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In the marine sector, traditional GIS skills are less well developed than they are in terrestrial sectors. The marine sector, in terms of adoption and understanding of digital geospatial data (and GIS as a key enabler), is some years behind the terrestrial sector in the UK. This has hampered the development of digital adoption not only in the hydrographic sector, but also across U.K. ports and harbours and offshore sectors where paper-based work practices are still commonplace. In Government, divergence of career paths as a result of the introduction of Mapping and Charting grades in the Civil Service in the 1980's led to 'marine' seeing itself as different to 'terrestrial'.

We believe there is scope to streamline the number of individual government departments and agencies operating in the marine and coastal data domains (e.g. The Crown Estate, UK Meteorological Office, UK Hydrographic Office (UKHO), Defra, CEFAS, JNCC, MMO, Natural England, Historic England, MCA, BGS, Ordnance Survey). While the coordination of hydrographic survey work, for example, has improved in recent years, there is the potential to go much farther.

In particular, as well as with survey work, coordination should be extended to include the creation and maintenance of higher-level data products or services. Without this, products and service will be created multiple times in an ad hoc manner, incurring unnecessary expense and resulting in inconsistency.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

While more data is being made available under an Open Government Licence, which we consider a positive step forward, there is still much work to be done in respect of the structure and quality of this data.

There are numerous fundamental datasets where there is no authoritative 'ownership' body, despite the overlap in some areas of responsibility described in Q3. There are certain datasets where no organisation is able or willing to take on the responsibility for its effective management and curation; data and information obligations need to be clearly defined in public task.

This has been a topic of concern for the Marine Environmental Data and Information Network (MEDIN) for some time. As an example, the data register for Marine Spatial Planning identified 350+ datasets. Only a few of these datasets could be used immediately without significant rework or compromise. A typical example of a problematic marine data resource is submarine cables:

1) Historically the most comprehensive datasets were held by BT Marine and Cable & Wireless, but when these organisations were privatised, rather than the datasets being preserved and held as a national asset, the datasets were also transferred to the private sector. This historic dataset is now available in 'Geocable', a licensable software product, where the data is accessible only via the application.
2) The UK Hydrographic Office (UKHO) admits it is not the authority responsible for submarine cables, the Kingfisher Information Service (and associated industry bodies) are only interested in 'live' cables, and the leasing and licensing authorities (e.g. The Crown Estate and Marine Management Organisation (MMO)), who arguably should know what has been leased/licensed, state that it is not their remit either. It should be noted that UKHO takes cable data from various sources, including Geocable, that it then depicts on navigational charts. However, only cables of navigational significance are included. Recently, UKHO has been removing cables from charts that are in water depths greater than 20 metres (below Chart Datum), as they are not considered navigationally significant. Navigational charts are therefore not a definitive source of cable data fit for wider use, such as in marine spatial planning, as stated in our response to Q1.

With respect to source data generally, in the Geospatial Commission's consultation documents, the UKHO is promoted as being UK's marine geospatial data centre of excellence. In reality, it is more a centre for excellence for the production of navigational products and services. UKHO is responsible for very little of the data that it publishes, most data being sourced from other parts of government and the private sector e.g. ports, harbours, energy and telecoms companies.

The UK has no interoperable land-sea data despite numerous attempts to create

a seamless terrain model across the littoral zone. In 1991 the original Integrated Coastal Zone Map was produced by Ordnance Survey (OSGB) and UKHO. Sadly, whilst OSGB had the processes to handle digital data, the UKHO did not. The project was abandoned after just one paper sheet of Langstone Harbour was produced. A further project funded by HM Treasury under its 'Invest to Save' initiative in 2001 again fell by the wayside because the three agencies involved, OSGB, UKHO and BGS had, at that time, different governance models and priorities, and would not commit to developing the required terrain model.

In 2010, SeaZone Solutions Ltd. created marine mapping that was harmonised with land mapping from OSGB for six port cities, including London, for use by security services leading up to the 2012 Olympics. Sadly, after its initial success no sponsor in government could be found to maintain the harmonised dataset.

Presently, OceanWise has picked up this longstanding goal of creating marine mapping harmonised across the coastal zone, and has done this for three pilot areas, but ultimately this requires cooperation from OSGB to support the maintenance of the landside of these interoperable datasets.

Engagement with OSGB over many years has resulted in little progress, presumably because it has not been prioritised. Furthermore, as we have pointed out to OSGB, the coastal zone data in OSGB's datasets e.g. Terrain 5 and 50 are deficient in that the coastline is stepped between tiles (rather than being a continuous surface) and the marine area is populated by nonsensical values.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A fundamental change is required to identify authorities which hold data as part of their public task, and therefore, should be responsible for maintaining the data as a national asset. We can provide numerous examples based on our experience preparing data registers for marine spatial planning for the MMO, for example.

Those core datasets can be published directly, or the custodian provided with the stimulus to make these datasets available to value added service providers, such as OceanWise, which are in a much better position to understand and react to user needs and market forces.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

EO data is still considered novel and contentious by some marine data holders.

OceanWise considers the introduction of EO data in the marine as a useful option especially in defining coastal morphology and artefacts. Its usefulness in providing accurate water depths greater than 20-30 metres, even in clear water, remains limited. That said the market for this data has increased in the last five years mainly from scientists and planners.

The value of EO data to support oceanographic and hydrographic applications is not yet proven. UK Catapult is actively seeking new applications for EO data to assist the marine sector become more innovative and competitive.

OceanWise supports these initiatives but warns that on occasions public money has been used to create data products and services where there is already a successful company undertaking this role. We believe therefore that all public funded data related initiatives MUST include an impact assessment to include existing interested parties and markets, and potentially then allocate funding where it is more appropriate.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

In the marine sector, the increased deployment of autonomous underwater and autonomous surface vehicles (AUV/ASVs) will reduce the cost of data gathering. The National Oceanography Centre (NOC) should be commended on developing innovative platforms but appears to have missed the opportunity to develop commercial products from this initial success; the USA and Norway currently being the leading nations for commercial systems.

There is potential for greater industry involvement in marine monitoring programmes. This would facilitate private – public data sharing and help UK industry further develop expertise and systems with significant export potential. A lot has been achieved in this area but much more could be achieved with the right collaboration.

More generally, there is an emphasis on the platforms and sensors but less on data handling and the creation of end user products and services. OceanWise has attempted to raise this issue within UK Catapult, for example, but to date without success, presumably as it is not considered a priority for investment. We believe this is a mistake.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data underpins many different applications in so many ways, although this is often not recognised and certainly not at conceptual or design stages of many initiatives. The same can be said about data management generally.

OceanWise is actively involved in extending its marine mapping and environmental data sharing platform (aka marine IoT) to support such initiatives as 'Smart Ports', a key goal for Maritime 2050. This, and similar initiatives such as Smart Cities, will struggle or be less successful without the underpinning geospatial datasets and technologies to support them.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Geospatial data is never free, someone pays for it. Data made available by Google, for example, comes at a price i.e. Google's business model is to make geospatial data freely accessible as a hook to charge users through advertising or by exploiting their personal data (with their agreement). There needs to a wider and more insightful debate and how geospatial data is paid for, who pays for it, and to consider risks associated with relying on a purely public funding model.

Generally, we believe data acquired at public expense should be made accessible and the development of products and services based on these datasets should be left to the private sector. However, the capture, processing and publication of all data can - and arguably should - involve the private sector, which is more adept at being innovative and delivering value added data products and services to users.

The UK is in an excellent position to develop private – public sector partnerships to further exploit the capabilities of its leading geospatial data institutions and companies, as long as the institutions properly engage in this aim. There are too many people working in these institutions that see private enterprise as a bad thing, or as competition, rather than considering that if they worked with industry then everyone, especially UK plc, would be likely to benefit. Data sharing and working with industry should therefore be part of every applicable institution's public task.

As an example, OceanWise successfully works with UKHO to create products and services that it licenses to the private and public sector. The reduced licence fees paid by the public sector help fund the development, maintenance and support of these products and services, which are also licensed to the private sector at a higher price. A royalty is paid to UKHO for every data licence sold. Use of the data products and services by the public sector, and by further and higher education, provides credibility.

This model is now being exported by OceanWise to the benefit of OceanWise's stakeholders (i.e. its shareholders, employees, suppliers and local communities), and the UKHO and its stakeholders, and therefore UK plc.

UKHO effectively operates this model via its Admiralty branded navigational

products and services, which it understands and does well. In doing this, UKHO operates both as a private sector body (Admiralty Publishing Ltd. if you like) and as a national Hydrographic Office (i.e. data holder).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The requirement for geodetic models to underpin positioning is vital. In the marine sector, the UKHO commissioned the UK and Ireland Vertical Offshore Reference Frame (VORF) a decade or so ago but the model was not made widely available to industry. This essential resource should be updated and made more accessible.

The recent data gathering programmes in the UK Overseas Territories (UKOTs) and commonwealth countries are designed to stimulate economic growth which could generate opportunities for UK business in the development of geospatial datasets, applications and services. One example is the Commonwealth Marine Economies (CME) Programme, which is delivering survey data to small island states in the Meso America and Caribbean region. Despite best efforts, engagement with private companies, by the responsible government agencies, has not been forthcoming thus opportunities to assist those small island states to date have been very limited.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As stated in Q1, OceanWise fulfils an essential role in providing marine mapping to the public and private sectors in the UK and farther afield, whilst the UKHO focuses on its core business of charting, which it does very well. It readily admits (at least to OceanWise in private) that UKHO does not possess the necessary skills and market understanding to fulfil such a role.

The work that OceanWise does involves taking source data where it exists, but primarily re-engineering source survey data and data captured from paper charts and making it suitable for use in desktop and web GIS e.g. as a seamless vector and gridded datasets UK Waters.

Looking ahead, the worst that could happen (and not only for OceanWise's business) is that UKHO makes its charted data available to non-navigational users without due regard to the fitness of purpose of these product-based datasets for use in wider applications, such as marine spatial planning.

OceanWise provides the UK input to EMODnet and our marine geospatial data products and services are gaining traction worldwide; we currently have contracts

in the Caribbean, Middle East and in South East Asia. Although OceanWise enjoys a good relationship with UKHO as a licensor, we have identified key areas where the management and supply of UKHO data could be improved and are in discussion with UKHO about this. Note that we also take source data from a number of international and national bodies e.g. the International Maritime Organisation (IMO) for which we pay a royalty for the use of the data.

Moreover, we believe that there are greater opportunities to be harnessed by OceanWise and UKHO collaborating to meet the emergent global demand for GIS related products and services for the benefit of UK plc.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

A lack of authoritative source datasets as indicated in Q4 above. The quality of the datasets that are available. Competition from government itself by recreating products and services that are already in the market place and available at a lower cost, more so when personnel costs are taken into consideration.

OceanWise's vision is to create marine mapping that is harmonised with land mapping from, for example, Ordnance Survey (OSGB), an example output being an interoperable land-sea terrain model. Although OceanWise can proceed with the pilot dataset initiative alone, we would rather do this in collaboration with OSGB/OSNI as the interoperable datasets should be maintained either side of the assigned coastline.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Addressing the core issues e.g. authoritative datasets.
Stimulate a greater appetite for publically funded data to be shared and re-used
Public-private sector collaboration.

Trusting the private sector to deliver innovative products and services more cost effectively than Government thus benefitting UK users, and which would also stimulate business opportunities and growth overseas.

Presently, OceanWise has framework agreements with Scotland, Wales and Northern Ireland. We have promoted the benefits of a similar agreement within English and UK wide public bodies, but as yet these have failed to materialise. We continue to licence some of these bodies on an individual basis whilst recognising that collective are more cost effective for government.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Some organisations have been slow to update their policies and make data available as web services e.g. Historic England's wrecks database. Despite MEDIN funding, a successful pilot where the HE data was linked by OceanWise to its UKHO derived shipwrecks reference dataset is still not made available.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

A public sector marine mapping agreement (PSMMA), so that central and local government is using the same consistent base map, ideally harmonised across the coastal zone with terrestrial data.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As stated above, whilst marine may not be a priority this may not matter, as OceanWise and UKHO already enjoy a healthy relationship, and only minor adjustments are required in order to maximise the benefits from this relationship. Ideally this would be done in collaboration with other agencies, e.g. OSGB with regard to interoperable land-sea geospatial data, and BGS. Such collaboration would not only benefit UK public sector but boost overseas export potential.

Q17: Are there any other areas that we should look at as a priority?

None that are not included in our response to other questions.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Application based products and services. Situational awareness, risk management, foundational datasets for big data type initiatives e.g. Blue Marine Foundation's Big Marine Data Project involving OceanWise and the RNLI.

OceanWise provides GIS and related services to ports and harbours. There is scope to streamline ports' compliance responsibilities with those of the public sector.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Collaboration and cooperation between the private and public sectors, especially where UK Government already has a foothold e.g. Cefas in Kuwait; UKHO in South West Pacific and UKHO/NOC in the Caribbean. OceanWise is also active in these areas and better collaboration would enhance the likelihood of greater success.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The UK leads this field in the private (e.g. OceanWise) and public (e.g. UK Hydrographic Office) sector. What is missing is greater collaboration to realise the greater potential that this could deliver.

As stated above, OceanWise helped establish and is a major contributor to the IHO Marine SDI Working Group, having delivered training courses and mentoring to countries on this topic for almost 10 years. We have seen considerable uptake of national SDI, and the engagement of national marine bodies, especially in South East Asia over this period. UK is struggling to grasp the opportunities to be harnessed by a greater public-private partnership approach to overseas programmes and projects.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

OGC's Response to the Geospatial Commission's "Call For Evidence"

Please submit your completed questionnaire to:
geospatialcommission@cabinetoffice.gov.uk.

About you and your organisation

Name	[Text redacted]
Organisation	Open Geospatial Consortium
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Other - please state **X**	**International non-profit standards development organisation**

A preface to the OGC response to the call for evidence

The Open Geospatial Consortium (OGC) is a not-for-profit voluntary consensus standards organisation with over 520 members and a worldwide presence. The OGC membership in the United Kingdom is the third highest number of members in any nation and has many other international industry organisations with a local presence. Since the the “call for evidence” was announced we have held two face to face meetings in London with members as well as an online webinar and engaged with a variety of our alliance partners including the AGI, RICS, buildingSMART and others to assist in developing this response.

Whilst this response will focus on the relevance of the open geospatial standards that are developed in the consortium we have added where appropriate information and comments provided from throughout the membership and also references to activities we are aware of through our alliance partners.

About the OGC

Of our 520 strong global membership approximately 40% are commercial service providers, systems integrators, and technology providers. The members range from small and medium-sized enterprises to large multinational organisations in the public, private, academic, and not-for-profit sectors. The Consortium was established in 1994 and offers a wealth of historical records, reports and presentation materials relating to geospatial problem-solving. Our goal is to define and deliver the industry standards platform for location interoperability across the web, wireless, and mainstream Information and Communications Technology (ICT). The OGC is the only industry consortium that comprehensively addresses issues related to location and space to enable the integration of all spatial data types and real-time spatially related technologies, including but not limited to the enterprise, cloud, mobile, and sensor environments.

OGC processes and standards facilitate a common depiction of information for multiple organisations which have varying perspectives on the spatial nature of content that need to be merged. OGC's value derives from the fact that spatial information is pervasive in human activity and only a well-run, global, consensus standards process can provide the environment to make location information ubiquitous in mainstream information processing. OGC members collaboratively define and develop the interoperability architecture needed to solve simple to significantly complex problems that involve the integration of dissimilar computing models important to a wide variety of communities. The development and use of open standards do not require members to give up intellectual property or trade secrets.

The use of open standards to connect components, applications, and content allows a “white box” view on the components' functionality and interfaces without revealing implementation details. This fulfils both the industry requirement for protection of intellectual property and the user requirement for transparency. OGC members

collaboratively define and develop the interoperability architecture needed to address simple to significantly complex applications that involve the integration of dissimilar computing models important to diverse communities of interest. With over 70 working groups, the spectrum of OGC's work currently covers a broad and expanding range of domains and technology areas.

OGC manages four main programs:

• Standards Program - The OGC community works in a formal consensus process to arrive at approved (or "adopted") OGC® standards http://www.opengeospatial.org/docs/is

• Innovation Program - The OGC Innovation Program (IP) is an essential part of OGC's fast, effective, inclusive user-driven process to develop, evolve, test, demonstrate, and promote OGC Standards. Over the past 16 years, OGC's Innovation Program has conducted over 100 initiatives designed to accelerate the development of emerging concepts and drive global trends in interoperability. http://www.opengeospatial.org/ogc/programs/ip

• Compliance and Certification - The purpose of the program is to increase system interoperability while reducing technology risks. Vendors gain confidence that they are providing a compliant product, whereas buyers gain confidence that a compliant product will work with another compliant product based on the same OGC standard. http://www.opengeospatial.org/compliance An important component of achieving interoperability in solutions is to ask for compliant software. There is an OGC Guide to Software acquisition that provides advice on how to achieve this https://portal.opengeospatial.org/files/15-002r5

• Outreach and Communication - The permanent success of any standards effort depends on users consistently choosing products based on those standards. The purpose of this program is to lead outreach and education, nurture strategic partnerships and alliances, and develop and support regional and sector programs.

OGC operates on both a virtual and in-person basis, with quarterly meetings scheduled each year in North America, Europe and Asia.

What are Open Standards and why are the important ?

In 2014 OGC, the International Standards Organisation committee TC211 and the International Hydrographic Organisation jointly presented a Guide to the Role of Geospatial Standards to the United Nations Global Geospatial Information Management committee. The Committee endorsed the guide and its companion document as recommended international best practice. Both the current versions of the guide and its companion document can be found at the following links:

- http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Standards_Guide_2018.pdf

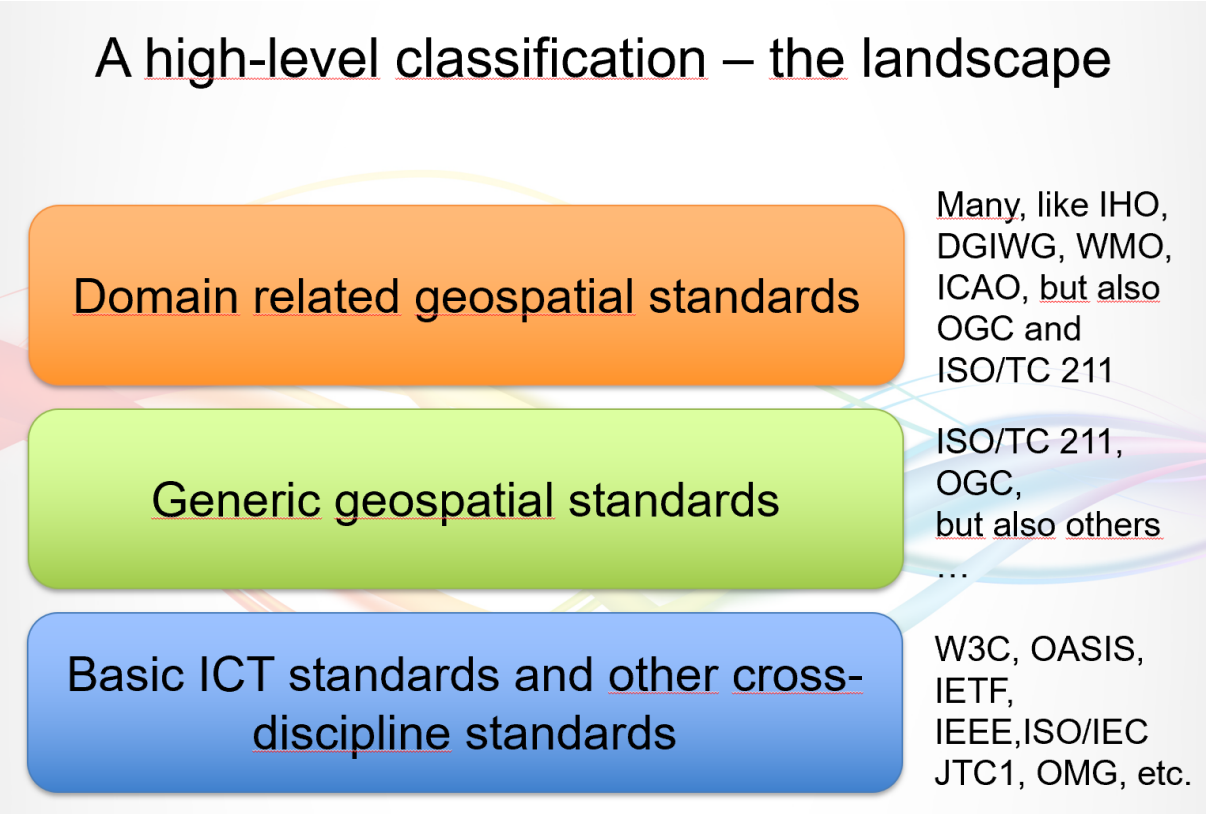
- http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Standards-by-Tier-2018.pdf

These documents state that the goal of open standards it to achieve interoperability and to do that an open standard must be:

- Publicly available;
- Unencumbered by patents and other intellectual property;
- Anyone can download and use the standard (nondiscriminatory);
- No license fees;
- Vendor neutral;
- Data neutral;
- Agreed to in a consensus decision making process;
- No single entity controls the standard

"Different governments and enterprises may choose to use geospatial information and software applications which do not rely on open standards. The most immediate drawback of such an approach is that the organization has created an information and technology silo that presents users with many hidden challenges such as delays and costs of expanding or adapting data and software tools to work with other resources, software or organizations. In an ever changing world, open standards help assure that organizations can more quickly take advantage of new geospatial information sources and new technology tools. Open standards are a central element in the growing trend to open government"[1]

[1] Guide to the Role of Geospatial Standards http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Standards_Guide_2018.pdf



The world of technical standards can be a complicated one to understand and is very much a land of acronyms. However, it is important to realise that the standards development organisations (SDOs) all play an important role and focus on particular domains and technical areas and are reliant on

working with each other to ensure we can enjoy a globally connected world of data sharing and access. The diagram above illustrates the 3 primary layers of standards that our geospatial community relies on and the column to the right indicates the various SDOs who are involved in that layer.

To help understand this landscape better the UN-GGIM in collaboration with the OGC, ISO/TC211 and IHO undertook to match existing standards to those global issue areas that have been identified by the committee.

	UN-GGIM issue	Number of standards		
		ISO	OGC	IHO
(a)	Developing a national, regional and global strategic framework for geospatial information	6	5	1
(b)	Establishing institutional arrangements and legal and common frameworks	5	2	7
(c)	Building capability and capacity, especially in developing countries	5	2	2
(d)	Assuring the quality of geospatial information	7	6	8
(e)	Promoting data sharing, accessibility and dissemination	63	24	15
(f)	Embracing trends in information technology	20	18	3
(g)	Promoting geospatial advocacy and awareness	-	4	2
(h)	Working in partnership with civil society and the private sector	-	-	-
(i)	Linking geospatial information to statistics	7	6	-

OGC in the United Kingdom

There are over 30 member organisations in the United Kingdom

1Spatial Group Ltd.
Beare, Matthew
cadcorp (Computer Aided Development Corp.) Ltd.
Defence Geospatial Information Working Group (DGIWG)
Defence Science & Technology Laboratories (Dstl)
DEFRA
Envitia Ltd.
Esri UK
European Centre for Medium-Range Weather Forecasts (ECMWF)
Frazer-Nash Consultancy Ltd
GE Smallworld
Helyx secure information systems ltd
HR Wallingford
International Association of Oil & Gas Producers (IOGP)
Natural Environment Research Council (NERC)
Office for National Statistics
Ordnance Survey
OSCRE International Ltd.
Polar View Earth Observation Limited
Royal Institution of Chartered Surveyors (RICS)
Satellite Applications Catapult
Science & Technology Facilities Council (STFC)
Scottish Government
UK Met Office
United Kingdom Hydrographic Office
University College London
University of Manchester
University of Nottingham
University of Reading
University of Southampton
whitehead, brandon

These members represent all tiers of government, small companies, large corporations, research institutes and universities. The UK also has the first ever European based Strategic member being Ordnance Survey. As well as organisations who are based in the UK a number of international member organisations have a presence here these include IBM, Google, Hexagon, ESRI, Oracle and many others.

In order to discuss and share regional knowledge there is a UK & Ireland Forum. This is currently chaired by Andrew Hughes of the British Geological Survey and meets between 3 - 4 times per year. This forum has built a partnership with both the Association for Geographic Information (AGI) and their standards committee IST36 (British Standards Institute) to help maximise the development of appropriate standards and supporting material to achieve interoperability in the UK.

On a final note, it is important to highlight that the INSPIRE framework is underpinned by many OGC standards in particular the webservice standards and it is encouraging to hear that the UK intends to continue following this framework for geospatial interoperabilty for the foreseeable future despite the political changes in the relationship between the EU and the UK.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

One of the great challenges for the geospatial community and those outside it is agreeing on terminology. The list as defined is fine, but we would encourage the use of the term “geospatial resources” rather than types as the overall description of the list. This avoids the situation where type 1 is called ‘geospatial data’ and is also a type of ‘geospatial data’. Having an agreed definition that is then consistently used is important for helping everyone to understand. It should be noted that some members indicated that it is important to define the distinction between data and information.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Best practice in terms of use of standards and metadata should be encouraged as early as possible within the educational system. For example, geospatial standards should be mandated in the Secondary School or University curriculum. Further at degree level the understanding of interoperability should be introduced. Good examples of this can be found in curriculums at both University of Nottingham courses and University of Southampton, but broader and more consistent coursework not just in GIS/Geospatial courses is key. Understanding concepts of geospatial and the importance of interoperability for geospatial data is important to those studying Computer Science, Environmental Sciences, Engineering and even Health. All these disciplines would benefit from earlier exposure to some basic understanding of the complexities of geospatial data and the importance of the standards that relate to it. Concepts and practice such as geospatial analytics, particularly in a Big Data context should also be taught or at least introduced. Additionally, System-of-Systems engineering, particularly in the context of a UK-wide Sensor Web/IoT that is underpinned by standards-based technologies should be developed.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Whilst the OGC supports geospatial professionals in achieving interoperability, organisations such as AGI (www.agi.org.uk) and Royal Geographical Society (RGS) are best placed to respond to the issues related to skills needs within the UK context. These are valued alliance partners of the OGC and we support their position on skills

and gaps in UK-based organisations and are encouraged by their proposal to conduct a study in the geospatial skills gap.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The UK has made great strides in making their public sector data more available, e.g. data.gov.uk. However general sentiment among members is that this portal is not as well set up to handle geospatial data as it could be. Further metadata is not well policed which makes finding data more difficult than it should be. It is suggested that the data itself and even good metadata catalogues should not be moved, but the interconnectedness of catalogues should be observed, i.e. Single source of truth. It's not as well curated as it could be. One suggestion provided was that the way forward could be to re-organise data.gov.uk to focus on the challenges of the UK in a thematic way. The case study themes outlined in Question 12 may provide a starting point for this. And in order to achieve single source of truth, organisations should be encouraged to take an open standards approach and provide data through webservices and APIs. Ensuring data is available and accessible for each of the cast study areas will be critical to addressing the challenges in each.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Addresses are one type of administrative data and addressing globally is created and managed in a variety of ways. As OGC Board Member Ed Parsons of Google is quoted to say "If you can't link to it does it exist?[2] The world is moving towards this idea of "linked data" and future address data will need to consider how it will connect to this new linked world. Key standards in this space will be the Discrete Global Grid Systems (DGGS) http://www.opengeospatial.org/projects/groups/dggsswg and Spatial Data on the Web Best Practice https://www.w3.org/TR/sdw-bp/

Obviously the main addressing system of the UK is the Post Office's post code system. This should be preserved, but mapped to an international standards and made openly available to maximise its use.

[2] Ed Parsons https://www.edparsons.com/2017/09/cant-link-exist/

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Members would encourage the UK to develop Sovereign satellite systems, while continuing to participate in ESA if possible. Further the UK should look to collaborate more with NASA and build collaboration with other national EO systems and Space Agencies e.g. new Australian Space Agency, China and others. Consideration should be given as to how to exploit existing data and use EO assets. Alongside this the GC should improve national connectivity between EO responsible bodies/orgs eg. UK Space Agency, etc.

To drive up the level of innovation for the use of EO data then the GC should encourage agencies to provide data in the easiest and best way possible. One potential solution is datacubes – important for not only research but enabling access to EO time series data for use by SMEs in a size that they can use. The OpenDataCube project is a global community in support of developing this technology and includes the Satellite Applications Catapult in the UK https://www.opendatacube.org/projects

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are a number of reports that have examined this issue which the GC are encouraged to digest.

These include but are not limited to:

OGC Technology Trends
- www.opengeospatial.org/OGCTechTrends

UNGGIM 5 – 10 year trends
- www.ggim.un.org/knowledgebase/KnowledgebaseArticle50444.aspx

AGI Foresight Report
- www.agi.org.uk/news/foresight-report

Location Based Marketing Association: 2018 Global Location Trends Report
- www.thelbma.com

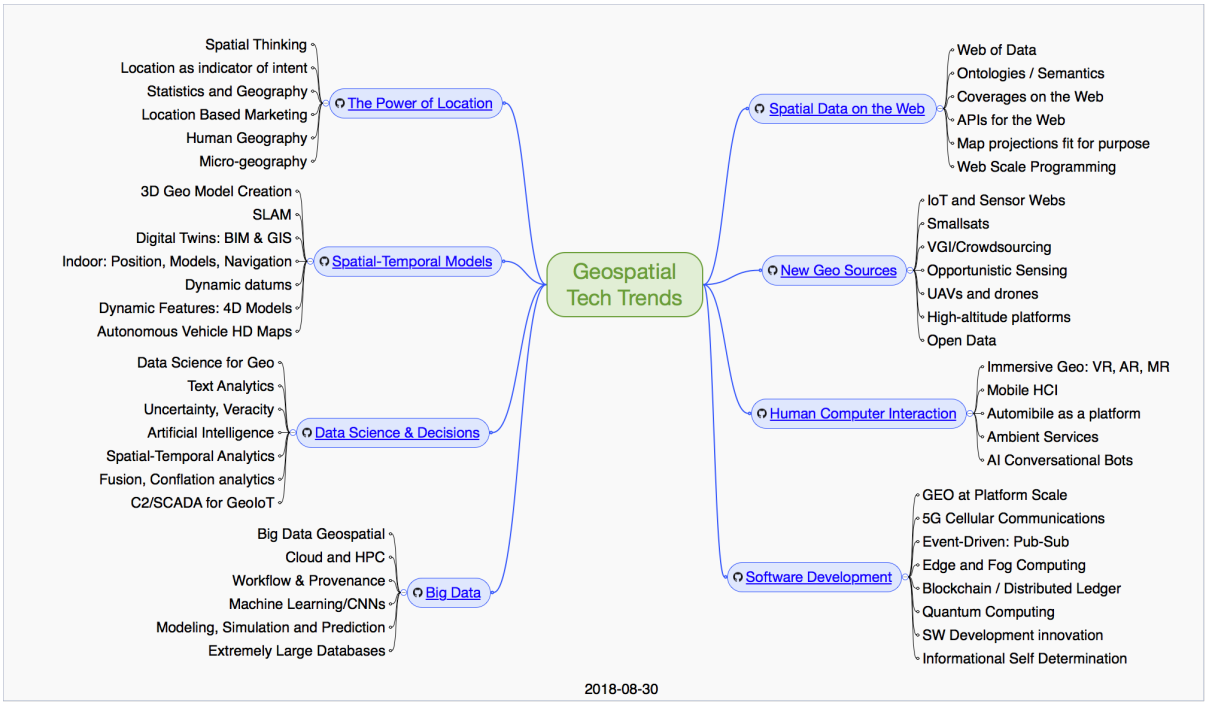


Figure from the OGC Technology Trends as at August 2018

It should be noted however that technology is a tool and it is more important to focus on the problems that need to be solved and how emerging technology can help to solve them.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Ensure that the geospatial data and applications support open geospatial standards. This allows innovators to focus on the problems they are trying to solve and not on re-inventing the wheel. The INSPIRE framework (www.inspire.ec.europa.eu) is one that can underpin this work.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Ensure that appropriate cost recovery is in place or appropriate central funding to ensure not only maintenance of core National geospatial data assets, but funding that enables the evolution of these assets as technology changes and needs of users change. Eg. OS Mastermap. Additionally, focus on the value-added services that public sector organisations can offer such as derived products, consultancy and analytics.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Ensuring an open standards compliant approach across all technology capturing or sharing location data will ensure an effective infrastructure that operates well together and accepts playing with new friends. We would see standards as a critical piece the UK's geospatial infrastructure.

A priority should be how reusable or multi use infrastructure is such Smart City technologies underpinned by Sensor Webs. For example, having a variety of sensors on streetlights could help people manage their health better (i.e. air quality). It could also help people prepare respond to floods and other natural disaster (saving local economies a lot of money). They could also be used to assist logistics companies in tracking vehicles or support Law Enforcement.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

UK geospatial data assets should provide a platform on which the private sector can offer its analytical and value-added services. For example, it should be possible for marketing information referenced to UK geospatial data assets to be augmented with statistical data/demographics readily. A user should be able to review a UK Govt catalogue of all of the other information that they could reference to each UK Govt geospatial data asset. Further use should be made of international initiatives such as the UNGGIM Guide to the Role of Geospatial Standards and also the work on Fundamental Data http://ggim.un.org/UNGGIM-wg9/

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

In terms of specific standards it is important to highlight the outputs of the report from the IST36 UK Geospatial Standards for the UK. https://www.agi.org.uk/about/resources/category/80-standards-group?download=343:standards-committee-minutes-21-sep-2018

In this report the key UK geospatial data agencies shared which geospatial standards they used. Encouragingly a number of these were the same. Below is an excerpt from the report:

Emerging consensus

A number of standards were mentioned by quite a few presenters, and therefore represent an existing consensus at least in some areas. Most of these are standards encouraged by the European Commission's INSPIRE initiative, for metadata, map views, feature access, and feature data. The INSPIRE specifications for various themes were also mentioned.

Data access standards

The consensus on the day was in the area of data access – perhaps reflecting that open standards are most apparent at organisations' external interfaces. • OGC Web Map Service (WMS; ISO 19128; INSPIRE) – seven organisations • OGC Web Feature Service (WFS; ISO 19142; INSPIRE) – five organisations • GeoJSON / IETF RFC 7946 within its capabilities – five organisations • OGC Geography Markup Language (GML; ISO 19136; INSPIRE) – four organisations Emerging (three organisations each): • working with REST architectural patterns. • forms of JSON other than GeoJSON • XML other than GML • CSV, including 'CSV for the web'

Metadata for discovery, evaluation, and use Most organisations publish their metadata using ISO 19115 / 19119 / 19139, as advised by INSPIRE, and use the UK GEMINI profile & guidance. This is the structure and format used by data.gov.uk, as well as by some off the shelf solutions.

Gazetteers The UK's own standard, BS7666 Spatial datasets for geographical referencing, which underpins Local & National Address Gazetteers was mentioned by four organisations.

We would encourage the GC to use the information gathered in this report to build supporting policy and strategy on the use of geospatial standards throughout the UK.

CASE STUDIES

The responses to this question were many and varied. To try and capture the essence of the member input we have described case studies that members see as the current key challenges that face the UK and how improved geospatial data access would assist.

Britain is an established industrial nation and its housing and infrastructure is based on significant construction around 150 years ago. For example, London's sewers were built in 1860s (en.wikipedia.org/wiki/Joseph_Bazalgette) and designed for a population of two million against a current one of 8.6m. If the UK is to cope with rising urban populations, climate change as well as competing in an increasingly globalised

marketplace then the next few decades need to be increasingly digital. Cities have to become resilient and sustainable as well as smart to respond to these challenges. The following illustrates the individual components or use cases based on contributions from OGC members and which are required to be met to enable these challenges to be addressed.

The use cases:

Civil Society – The aim of the GC is economic growth but should include well-being and its associated data. There is a linkage between physical processes and their data and well-being. For example atmospheric pollution is currently linked to increased deaths from respiratory disease; behaviour change and accessibility in terms of place should be considered. Alongside this, the Office of Civil Society within DCMS has put out a well-being strategy (see https://www.gov.uk/government/publications/civil-society-strategy-building-a-future-that-works-for-everyone) which should be taken into account along with the UN's Sustainable Development Goals or SDG.

Water - This is obviously important for sustaining human life, but too much results in floods and too little causes droughts. Already there are various APIs exposing data for river flows and groundwater levels (www.shoothill.com/Floods&Rivers) as well as trial ones for rainfall (environment.data.gov.uk/flood-monitoring/doc/rainfall). However the picture is not complete by any means and examples such as the NZ adoption of WaterML should be investigated (https://www.oecd.org/environment/resources/New-Zealand-water-quality-data-case-study-information-system-diffuse-pollution.pdf).

Underground - If the infrastructure required for increasing urbanisation and the officiant transport of goods and people is to be achieved then the use of the underground is key. Further to enable the best use of urban areas (e.g. Singapore) is to be made. However, underground space is not regulated (or is fragmented at best, e.g. mineral rights). If we are to enable the efficient use of this space then an understanding of what is "down there" is required. Data needs to be made open and to be shared using common standards. One example of this is KLIP in northern Europe where data can be exchanged on infrastructure projects (www.klip.be) and the OGC is promoting this process via its UG CDS and subsequent pilot (see www.opengeospatial.org/projects/initiatives/ugipilot).

Natural hazards - Than natural world is still a threat to human beings and their activities, even in the UK: landslides, floods, earthquakes and impacts of hazards from overseas origin such as Volcanic ash and tsunamis can affect the UK. Short term – "disasters" and longer term built environment and their effect on safe operation, e.g. nuclear power stations. Data on the historic occurrence and the processes that lead to these hazards need to be made available. This will enable those tasked with dealing with these hazards or their consequences is required. The approach has been adopted by the Natural Hazard Partnership, which is an example of cross-

governmental working for environmental prediction within the UK (see www.naturalhazardspartnership.org.uk).

Met Office 3D/4D - It is self-evident that weather knows no national boundaries. Met Office outputs need to be consumed by a number of different organisations both onshore in the UK and offshore. The Met Community and the Met Office produce very large datasets with significant geographical coverage. All these data need to be shared with the relevant customer either other WMOs or users such as aviation, air quality providers, 1st responders and so on. The OGC standard NetCDF underpins the exchange of data (see www.opengeospatial.org/standards/netcdf).

Model/Sim - Putting numbers on things is extremely important to be able to assess what impact any change may have. Modelling and simulation covers quantification of processes as well as 3D simulation of events or gaming. Process models are proliferating along with the data they consume and produce. Some way of exchanging these data either once the models have run or whilst they are running is important. The Simulation Interoperability Standards Organisation (SISO) & OGC have recently signed a MoU and as this is complemented by the OGC standard OpenMI for linking models at runtime (www.opengeospatial.org/standards/openmi).

Public safety - Data are collected about what we do and how we move around our environment. These data can and should be protected, but the sharing of it with the appropriate authorities need to be considered. For example in emergency situations such as fire or terrorist incident. Consideration should be given to data sharing during routine events with large amounts of people, e.g. FA Cup Final and emergency situations such as a 9/11 type incident (see www.bloomberg.com/news/features/2017-08-10/nobody-knows-what-lies-beneath-new-york-city).

Urban Environment - As the world's population continues to urbanise, the available space for citizens to live safe and productive lives is under pressure. How do we find better ways to understand and use the space available in our urban communities while taking into account diverse and varied populations and landscapes? The capacity to collect and share high quality Location data is at the heart of understanding how we live, work and play in our urban environments and is key to helping us see the pathways to improving the lives of citizens. Topics such as transport, public safety, resilience and sustainability, building modelling, underground infrastructure, sensors and the IoT and the ever increasing world of big data and analytics all have relevance. Other related initiatives are the Integrated Digital Built Environment - a joint initiative of the OGC and buildingSMART international looking at how we bring into reality concepts, such as the Digital Twin, for our cities.

Further information:

Integrated Digital Built Environment: http://www.opengeospatial.org/projects/groups/idbesc

buildingSMART International: https://www.buildingsmart.org/

RICS: https://www.rics.org/uk/

UK BIM Alliance: http://www.ukbimalliance.org/

Unmanned Autonomous Vehicles / Connected Autonomous Vehicles - A key component of the UK Industrial Strategy focuses on the need for a national infrastructure capable of supporting a nationwide network of CAVs. Location data will be critical in the development of this infrastructure. As well as those vehicles on the ground the increased use of drones for both public and commercial purpose means an ever greater demand for geospatial data but importantly the ability to share that data to all the users who need it. This might be law enforcement, the public, the drone owner or the customer.

Key examples here are:

- the startup company Flock https://flockcover.com/
- Ordnance Survey's e-CAV project https://www.ordnancesurvey.co.uk/about/news/2018/ecave-project-uk-driverless-vehicle-infrastructure.html

Agriculture - With the UN predicting that 68% of the world's population will be living in an urban environment by 2050[3] the stress and challenge of not only producing enough food to feed the growing population, but having the resources to farm and produce that food are also increasing. Advances in technology provide many opportunities for the agricultural sector from use of EO, to sensors, autonomous equipment and high precision farming. However much of the data need is still not available to farmers, or is too difficult for them to use well. This could be soils data, water, climate, disease spread, etc. This will be a key challenge for every nation in the world, but for the UK with a very large population and comparatively small population, maximising use and improving efficiencies will be vital.

Further information regarding interoperability in the Agriculture sector can be found the Location Powers: Agriculture Summit held in New Zealand in 2017 http://www.locationpowers.net/events/1712newzealand/index.php

Marine - It was noted that the Marine sector did not seem very represented across this questionnaire and yet many challenges face the UK that are marine related. For example Smart Ports and how cargo is brought into a port and then moved through an urban environment/corridor to multiple location on land and the effect of Coastal erosion. Moving into the future it is important to consider how we will merge both

[3] https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

marine and terrestrial models so that we can understand the implications of planning decisions, commercial trade movement and environmental change between the land and the sea. In the standards world an important partnership between OGC & IHO has been develop to begin looking at some of the technical interoperability challenge in this space http://www.opengeospatial.org/projects/groups/marinedwg

Location Based Consumer Services - Much of the discussion thus far has focused somewhat on what we would describe as "traditional" geospatial areas. However to realise the estimated £11 billion in unlocked value the geospatial industry needs to reach out and connect with organisation in the commercial market space who are becoming more and more reliant on geospatial. The Location Based Marketing Association www.thelbma.com has members who are supermarket chains, global fast food organisations and telecommunications companies. The broad array of case studies https://thelbma.com/case-studies/ that have been gathered from this membership shows the amazing value that these commercial companies derive from using location data. However, there is still a divide between this innovative marketing world and our traditional geospatial community. If the GC could bridge a gap between the two there would be many benefits of collaboration. For example - if a company deploying indoor sensors for marketing purposes inside shops could also use the same sensors to connect to public safety services, both could benefit.

Integration of Geospatial and Statistics - The statistical domain is evolving to move from the traditional capture of data through surveys such as census, to a more dynamic integration of data from across a wide range of domains that can make statistics more timely, more accurate, and better understood.
Geospatial information is a key data source in transforming the way that statistics are produced as it has the potential to fit into every component of the Generic Statistical Business Process Model.

The complexity of bringing together survey, administrative, and big data with geospatial information and earth observation is driving an increased need for standardisation to support better statistical outputs. OGC has recently worked with members and the UN-GGIM Integration of Geospatial and Statistics Working Group to charter a new domain working group to look at the challenges. A few of the specific challenges under consideration within the proposed DWG include:

- Data integration – how can semantic web technology be used to improve the integration of geospatial and statistical datasets?
- Data Capture – how can geospatial data be used to include the capture and georeferencing of survey, administrative and big datasets used in the production of statistics?
- Data processing – as geospatial objects do not fit within traditional database structures these are currently handled externally to the rest of the statistical process through dedicated geospatial systems.
- Data exchange – given the lack of interoperability between statistical and geospatial data architectures, frameworks, metadata and standards, how can data be shared through a service orientated approach?
- Data analysis – a lack of comparability between geographic datasets at a national, regional, continental and global level makes international analysis

difficult.

- Knowledge – there is a lack of understanding within the statistical community of the geospatial tools and standards that can support the statistical system, and a corresponding situation with the geospatial community.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Firstly they should ensure that the quality of the data is not comprised by public release of the data. Funding should be made available to maintain and update datasets that are truly open and freely available. Secondly the GC should act as a broker/quality assurance/enabler to ensure that data from the public sector can be made available with good metadata in a usable format.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Based on OGC member discussion our recommended priorities for datasets to release should be:

1. Underground utilities data. New display methods are emerging (e.g. AR displays) that could help to deliver underground utilities data to telecoms engineers and city engineers in more effective ways.
2. Post Office postcode data (this might be difficult because the Post Office is now a limited company) or a suitably similar dataset
3. Sensor networks - enabling the release of these to be used by public bodies or private industry.

Please see answers to Q12 for a range of suitable use cases, including use of underground space and smart ports / transport networks.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

We would suggest that the GC exploits the many and various existing networks both UK and globally. They should operate a twin-track approach of working through and knowledge sharing:

Working through – AGI, OGC UK & Ireland Forum, RICS, UK BIM Alliance, to have topic/challenge based discussion and workshops

Knowledge Sharing – participate in and learn from the forums around the world that consider Geospatial data

They should collect requirements/visions from all regions around the globe. By harmonising those requirements, they can develop a Core/Foundation strategy that covers the key aspects that are important to all regions. Then provide the regions a framework for extending the Core/Foundation strategy by developing sub-strategies. Veto any aspects in the sub-strategy that contradict the principles of the Core/Foundation strategy.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Require local authorities to engage and participate in organisations such as AGI, OGC and others. These organisations offer several platforms for knowledge exchange.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

A list of use cases is provided in response to Q12, however the ones specifically that relate to this question are:

1. Connected and autonomous vehicles
2. Unmanned aerial vehicles (UAVs)
3. Use of underground space / subsurface
4. Smart ports and coastal processes / erosion in the context connected cities

Q18: Are there any other areas that we should look at as a priority?

Data and services to facilitate the development and use of underground space should be a priority. It is the key to unlocking cities and ensuring they are resilient and sustainable into the middle of the 21st century.

As well as this, there should be recognition of the role that research organisations play to stimulate and develop innovation that can be commercialised – An international example of a Public/Private/Research Partnership would be FrontierSI in Australia (formerly the CRC – Spatial Information) https://frontiersi.com.au/

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- Connected and autonomous vehicles
- e-Health
- Unmanned Traffic Management (in airspace mixed with UAVs and Passenger Aircraft)
- Sensor Web and Internet of Things (IoT)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

UK organisations should have more involvement in international organisations such as the OGC and UNGGIM. Alongside this, creating improved connection between UK agencies to as to provide a more "joined up" international offering, we have a lot to offer but it would be better with collaborative and joint agency approaches. Eg. UKHO, MO, OS, BGS, etc.

However, recognising the UK is in a strong position with both public and private sector organisations and their use of geospatial data then the GC should facilitate mentoring / Knowledge Sharing with countries of lower income, ie. DAC countries (http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/DAC_List_ODA_Recipients2014to2017_flows_En.pdf). This will spread UK's expertise and influence, but also test our approach in more demanding environments.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There are many exemplars that we could offer here. Two important regional examples to mention are:

INSPIRE https://inspire.ec.europa.eu/ Much has already been referenced to INSPIRE. However it is important to recognise that much of the data sharing and access we enjoy across the European region is thanks to this framework and the standards that underpin it.

ArcticSDI https://arctic-sdi.org/ The ArcticSDI is at present one of the best examples of data sharing in that is is federated network of national SDIs facilitated by open standards. This holds high the principle of "single source of truth".

At a national scale the ones highlighted below focus on particular exemplars within each continent:

North America

The United States is a good model to learn from. Their Spatial Data Infrastructure (SDI) was established by a Presidential Directive Executive Order 12096 in the Clinton Administration. Since then every US President has reaffirmed their commitment to SDI. Most recently through the signing of the Geospatial Data Act (https://www.congress.gov/bill/115th-congress/house-bill/3522) The work of the Federal Geographic Data Committee https://www.fgdc.gov/ is regarded highly throughout the world and the impact of the National Information Exchange Model https://www.niem.gov/ has greatly improved geospatial data sharing through the country. In Canada of note is the Spatial Data Infrastructure https://www.nrcan.gc.ca/earth-sciences/geomatics/canadas-spatial-data-infrastructure/10783. Mexico's INEGI has also pioneered the combination of GEO/STATs in one organisation.

Australasia

Australia has a number of excellent initiatives including GeoScience Australia's Digital Earth Australia work on Datacube, Discrete Global Grid System, Dynamic Datums and the long standing partnership between states and federal government through the Public Sector Mapping Agency as well as organisations such as CSIRO and FrontierSI which are world-leading in terms of open standards. As mentioned above, New Zealand has championed the use of WaterML to create seamless data transfer within the water environment and was one of the pioneers in publishing their open geospatial data in Geopackage format (as has the Australian Bureau of Statistics this year)

http://www.ga.gov.au/dea/odc
https://www.linz.govt.nz/
https://frontiersi.com.au/

Asia

Given its size and limited land mass, Singapore has space issues to deal with and is one of the world leaders in the use of CityGML and has been pushing the development of Underground city models in collaboration with the UK & New York. In India there is a focus on Smart Cities and involvement in Plugfests whereas Japan has a focus on transport.

Europe

In The Netherlands Geonovum is an exemplar as how a country handles geostandards and innovation, for other countries KLIP used to coordinate the use of the sub-surface for shallow infrastructure. France the geospatial community is integrated with Government activity eg. Interoperability Days. Whilst Germany has very strong 3D City Modelling eg. use for Solar Panel investigation, and urban planning

Africa

Tanzania - for use of both crowd sourced data in evidence based decision making, aerial drones for survey and exposing the aerial data via OGC WMS for use globally.

Lastly we would mention the developments in the Defence Community.and the end of the Cold War has seen a switch to different roles for the UK's Armed Forces with peacekeeping, assisting in natural disasters, preventing terrorism coming to the fore. This has meant greater links to the civil society eg. DSTL working closely with OS to fund important interoperability activity in the OGC tested eg. WMT links to looking at use of MapBox box tiles format and how to achieve greater interoperability.

To complete our response we would like to acknowledge and thank all our contributors:

[Text Redacted] - British Geological Survey
[Text Redacted] - OGC
[Text Redacted] - OGC
[Text Redacted] - IIC Technologies Limited
[Text Redacted] - Tapestry Innovations
[Text Redacted] - Ordnance Survey, Chair IST36
[Text Redacted] - Defra
[Text Redacted] - MetOffice
[Text Redacted] - MetOffice
[Text Redacted] - CAE

[Text Redacted] - Beare Essentials
[Text Redacted] - the ODI
[Text Redacted] - UKHO
[Text Redacted] - FNC
[Text Redacted] - HexagonSI
[Text Redacted] - DSTL
[Text Redacted] - MOD
[Text Redacted] - OS
[Text Redacted] - OS
[Text Redacted] - ONS
[Text Redacted]
[Text Redacted] - OS
[Text Redacted] - AwayTeam
[Text Redacted] - Envitia
[Text Redacted] - FutureCitiesCatapult
[Text Redacted] - Consultant

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Oil and Gas Authority
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial data should be thought about as an extra attribute that describes the 'where'. While this can take many forms (co-ordinates, place name, etc) it is related to a location. Therefore for 1 and 2 are the same thing. Geospatial identifiers (3) are just data too (i.e. a list of places with their coordinates).

Geospatial services are not data. This should be in its own segment with technology and applications.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The biggest gap in government has been enabling access to software and hardware to enable spatial data to be exploited. In my experience Government Digital Service and CO haven't been able to provide the support I've required in my roles at MoD, DECC, BEIS or OGA.

Skills within government are often limited to small pockets in individual Central Government Departments, Local Authorities and Agencies. Many organisations pull in experts for projects rather than maintaining and building skills internally or from a Government talent pool.

There needs to be better appreciation of geospatial technologies for non geospatial specialists, especially at management levels. Driving effective use of geospatial technology is often difficult for this reason.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The Oil and Gas Authority is part of a wider industry that has been a the forefront of spatial data and technologies since the 1960s. Careers in this sector require geospatial skills along with other Geoscientific and IT skills.
As a GovCo we struggle to attract and retain talent. This can only be addressed by raising the profile of geospatial/Geography/GIS to be a primary profession alongside being a geologist, economist, etc.
Geospatial professions also need to be recognised as specialist professions that require either a specific education or specific experience to acquire skills that cannot otherwise be 'picked up'.
In recruitment drives, the OGA has relatively few people that can write computer code and use ETL software, skills which will be key for cleaning data and applying future technology.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Although improving access is a key goal for UK geospatial data, alignment of similar data and alignment on means of sharing are prerequisites for this goal.

The Oil and Gas authority pulls in information from multiple Government departments including BEIS, TCE, UKHO, National Grid and others. These all vary in quality (as do our own datasets), however there is no central repository or single source of the truth for many datasets vital to the UK. Examples:

- Offshore infrastructure (Wind farms, Platforms, cables, pipelines)
- Onshore infrastructure (Pipelines (Oil, Gas or Water))

The OGA have passed legislation to enable this data to be collected in the future if held by relevant persons involved in Oil and Gas Activities.

Identifying the needs of various organisations is vital in understand what datasets need to be captured.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes. We don't make best use of current technologies. The majority of Government and public bodies are trapped in legacy systems, which are increasingly difficult to maintain and ultimately move away from.
It is common to see organistions trapped on legacy systems and unable to take advantage of SaaS options and new platforms.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No comments

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Enabling access to MS Azure, AWS and others along with the raft of spatial applications that can utilise this computing power (ESRI, R, MS services and Amazon Services).
That will then need to be followed by data management expertise.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

They will showcase the power of that technology and enable further investment in the data that underpins it. It will hopefully result in geospatial data and applications being seen as the new normal.
This is comparable to Uber, Google maps, etc. All underpinned by location, however a surprisingly low number of people realise that.

Clean geospatial data will be essential if to be consumed by future technologies. Geospatial applications and adding geospatial information to data can highlight and in some cases automatically correct incorrect data.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

This is difficult as the government isn't always the owner of this data. Therefore collecting, maintaining and enchancing data has to achieved through effective reglations and/or through Governments business as usual.
The link between the need for data and using it to make better decisions within government process needs to be made clearer. This will pave the way for effective regulation to be drafted that will mandate data owners to report to government.
It also needs to be recognised that, although we have some world-class datasets, we also have a lot of datasets which fall far below those standards. The time and resources required to improve them and the return on investment needs to be more widely understood.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

These technologies are driven by private sector use cases and economic factors. While I think there is room for the UK government to encourage inward investment in these areas I don't believe it to to the role of the Geospatial Commission.
I think the foundational geospatial work will enable growth in these areas.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Significant. Partnering with organisations such Microsoft, AWS, ESRI, etc would enable the UK to benefit from the worldwide experience these organisations have.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Legacy file download systems are common place across the public sector and cost significant time when attempting to keep them up to date on internal systems. Changes to methods of publishing or structure of datasets, though sometimes unavoidable, happens too often and causes further time to investigate changes.

In some cases, it is possible, even with legacy file download systems, to automate updates to datasets on internal systems at considerable time-cost. For others, however, automation isn't even possible.

The OGA publish data that can be consumed in multiple formats, all formats, API (machine to machine) services, and web displays of the data come from a single

source. API services are streaming the most current data live.
Areas of government that have enabled API web services and where this has occurred it has generated an industry in application development. This industry develops and adds significant value to the datasets for end users.

Example of the OGA doing this - https://www.esriuk.com/content/dam/distributor-restricted/esriuk-com/news/thinkgis/ThinkGIS-Issue45.pdf

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No comments

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comments

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

This is a difficult question and various attempts have been made by government to create a single strategy. These have had mixed successes. A key driver needs to be Government Science and Engineering Geography profession, which professionalises geography with a wide user group.

Variations to a strategy not only need to be regional, but account for the differences in multi industries all with differing user needs. What will underpin that is the skills in geospatial technologies, applications and data management as well as the investment spatial thinking at policy/strategy level.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Consistency and standards across local government. In reality is difficult without prescribing what IT, software, people, etc a local authority should use.
Another option would be to centralise the delivery of services underpinned by geospatial data.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

UK Oil and Gas National Data Repository (NDR) - https://www.ogauthority.co.uk/news-publications/news/2018/the-uk-s-first-oil-and-gas-national-data-repository-to-deliver-additional-value-and-inward-investment-to-the-uk/

OGA's Data Centre - https://data-ogauthority.opendata.arcgis.com/ & https://www.ogauthority.co.uk/data-centre/

The latter moved off gov.uk in October 2016 as it didn't support our requirements

or user needs.

Q18: Are there any other areas that we should look at as a priority?

No comments

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comments

Q20: How best can we make the UK's presence in the international geospatial world more visible?

It would require the UK to lead some exemplar projects and talk about these at various industry/vendor events around the world. We (UK Government) are already world leaders in some areas and many UK nationals present at events around the world.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The National Geosptial Intelligence Agency (USA) – Part of the US DoD. Responsible for supplying geospatial data and services to the US armed forces. Smart Dubai (UAE) – Excellent example of bring BIM and GIS together with public facing information.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Open Data Institute
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

1. We recommend that the Commission recognises that geospatial data is infrastructure and adopts the view of geospatial data infrastructure described in this response.
2. Geospatial data infrastructure[1] consists of five components, all of them important:
    a. **data assets**, such as identifiers, registers and datasets;
    b. the **standards and technologies** used to curate and provide access to those data assets;
    c. the **guidance and policies** that inform the use and management of data assets and the data infrastructure itself;
    d. the **organisations** that govern the data infrastructure;
    e. the **communities** involved in contributing to or maintaining it, and those who are impacted by decisions that are made using it.
3. Within geospatial data infrastructure are three types of data assets: identifiers, registers and datasets.
    a. **Identifiers** are crucial to the process of sharing information. Geospatial identifiers provide unambiguous labels or reference numbers for the things described in a geospatial dataset, such as lamp-posts, roads, houses, or administrative areas. They are fundamentally important in being able to make connections between data, which puts them at the heart of how we create value from structured data.[2] The UK's core geospatial identifiers include: TOID (TOpographic IDentifier); UPRN (Unique Property Reference Number); UARN (Unique Address Reference Number); Office for National Statistics (ONS) codes for administrative areas; USRN (Universal Street Reference Number), Land Registry Title Number; and Land Registry INSPIRE ID.
    b. **Registers** are lists of reference data that help to improve the consistency and quality in how data is published. They help to build confidence and trust in data by clarifying where different data stewards are referring to the same things in the same way. Registers are typically maintained by a custodian who defines the scope and contents of the list. The work of maintaining a list is often collaborative[3] requiring input from multiple organisations. Examples of registers for geospatial data in the UK include:

[1] https://theodi.org/topic/data-infrastructure/
[2] https://theodi.org/article/white-paper-enhancing-open-data-with-identifiers/
[3] https://theodi.org/article/registers-and-collaboration-making-lists-we-can-trust-report/

the Foreign and Commonwealth Office's country register[4] which provides a list of countries recognised by the UK; the Land Registry's official register of land titles, which will include the identifier and reference data for each title; lists of locations such as National Rail's list of railway stations[5]; and the EPSG Geodetic Parameter Dataset[6], which provides reference data about different coordinate reference systems.

c. **Geospatial datasets** underpin our understanding of the natural and man-made landscape around us and how we interact with it. They include data on land cover, height, geology, habitats, water resources, geographic and political boundaries, structures, addresses, utilities and transport networks.

4. We do not think it makes sense to consider "Geospatial services" as a geospatial data type. Products and services require access to geospatial data assets (identifiers, registers and datasets), as well as consideration of other aspects of geospatial data infrastructure such as guidance and policies. A strong geospatial data infrastructure supports an ecosystem of intermediaries and data users that create value-added geospatial services as well as derived datasets and products.
5. Geospatial data exists on a spectrum from closed, to shared to open[7]. Like other parts of data infrastructure, it should be as open as possible while respecting privacy, national security and commercial confidentiality. This is even more important for geospatial data infrastructure because it is a foundation for other parts of our national data infrastructure: restrictions on use of geospatial data can limit the use and utility of other data too.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

1. We think that everyone must have the opportunity to understand how data can be, and is being, used. In the context of the geospatial sector, the Commission should consider capability - data literacy and understanding, data science skills and the ability to use and share data to help solve problems - as an important area or theme.
2. The UK should be equipped with the skills in Artificial Intelligence and Machine Learning to take advantage of the increasing amounts of available geospatial datasets - including earth observation data and point clouds - to support the development of geospatial products and services. The Commission must recognise that not everyone needs the same geospatial skills and that there are

4 https://country.register.gov.uk/
5 http://www.nationalrail.co.uk/stations_destinations/48541.aspx
6 http://www.epsg-registry.org/
7 https://theodi.org/about-the-odi/the-data-spectrum/

different paths to expertise. The ODI's data skills framework is a useful tool for exploring this topic[8].

3. In addition to these skills, to realise the full benefits of geospatial data to the UK's economy and society, public sector policymakers and service designers, business leaders, startups and community groups need to have a basic understanding of the importance of geospatial data and how it can be used better to achieve their goals. These should include understanding how to navigate privacy issues that may arise when using geospatial data, and approaches for sharing geospatial data while protecting privacy. For example, this might include how and when to normalise or validate address data you collect so that the data is more shareable with other organisations, or how to ensure that Google Maps or OpenStreetMap (OSM) displays the location of a business accurately so that customers are more likely to discover it.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

1. No response to this question.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

[8] https://theodi.org/article/open-data-skills-framework/

1. Geospatial data infrastructure helps people, communities and organisations make decisions in almost all aspects of life and across all sectors of our economy. Limits on its openness - including who can access geospatial data assets - creates significant friction that reduces the benefits we stand to gain from it. In her foreword to the 2008 UK location strategy[9], [Text redacted] described that "in almost everything, people need to know when and where things happen: place matters." The UK must make geospatial data infrastructure as open as possible to maximise its value.
2. The Commission should prioritise increasing access to identifiers to help improve the quality, consistency and interoperability of geospatial and other data assets. It should work with both private, public and third sector data stewards to make identifiers available as open data that anyone can access, use and share[10]. A 2014 ODI and Thomson Reuters report[11] highlights the importance of open identifiers to make connections between datasets. Open identifiers are free from licensing or IP restrictions that might restrict how the identifiers can be used, including to publish derived data. The basic reference data associated with the identifiers should also be made available under an open licence. The report also highlights the need for data stewards to be transparent about how they assign and manage identifiers, and for the provision of a basic set of services that will support reuse of the identifiers (e.g. to help link together data assets from different organisations). At present, some of the key identifiers that underpin the UK's geospatial data infrastructure and that are not yet open are: TOIDs, UPRNs, UDPRNs and UMRRNs stewarded by Royal Mail; UARNs stewarded by the Valuation Office Agency; USRNs stewarded by GeoPlace; and Land Registry Title Numbers and Land Registry INSPIRE IDs. Two important identifiers, UPRNs[12] and TOIDs[13], both have some Intellectual Property (IP) and licensing restrictions which limit their reuse. For example, TOIDs can only be republished by Ordnance Survey (OS) customers[14]. The OS have over the last few years,[15] been permitting customers and licensees of their products to publish datasets that include UPRNs, although the licensing remains complex[16]. The UK has many competing[17] and overlapping identifiers for addresses, property and land which adds complexity to the publication and reuse of data. It is often not clear how

9 https://data.gov.uk/sites/default/files/uk-location-strategy_10.pdf
10 https://theodi.org/article/what-is-open-data-and-why-should-we-care/
11 https://innovation.thomsonreuters.com/en/labs/data-identifiers.html
12 https://www.ordnancesurvey.co.uk/about/governance/policies/addressbase-uprn.html
13 https://www.ordnancesurvey.co.uk/about/governance/policies/os-mastermap-toids.html
14 https://www.ordnancesurvey.co.uk/about/governance/policies/os-mastermap-toids.html
15 https://www.ordnancesurvey.co.uk/about/news/2015/uprn-release-sharing-location-data.html
16 https://blog.ldodds.com/2015/09/02/how-and-when-can-uprns-can-be-a-part-of-open-data/
17 https://www.owenboswarva.com/blog/post-addr2.htm

identifiers are assigned, how they relate to each other. Lack of reference data, including on boundaries, makes it hard to understand how they align with one another. The identifiers are also typically only published as part of larger datasets. For example, TOIDs and the basic reference data associated with them are only available as part of MasterMap products. This limits their potential uses.

3. The Commission should prioritise increasing access to geospatial data assets that are frequently used to validate or augment other datasets. Current barriers or restrictions to their use ripple through to other datasets, products and services. Two significant data assets of this type that the Commission should focus on are:
    a. Address data. We describe in detail how access could be improved and why this would be of value in our response to Question 5.
    b. The current work to increase access to OS MasterMap[18] is a step forward in strengthening the UK's geospatial infrastructure, but there's a lot more to do. In general, this will let users who only need small amounts of data to access it for free, on demand; it does not help those who need larger volumes or who want flexibility in what they do with the derived data they create. The current activities will create some new freemium models but these must continued to be revisited. They must be seen as a step on a journey to an OS Mastermap which is as open as possible, while protecting national security. Being clear that this is the direction of travel will allow both the OS and data stakeholders to develop appropriate business models.
    c. As the Commission opens up these datasets it must engage with public sector organisations that use them to create derived data, for example the Land Registry or local authorities, to ensure that associated licencing restrictions are removed from those derived datasets.
4. The Commission should prioritise increasing access to other geospatial data assets based on ongoing engagement with, and understanding of the needs of, data users. This is particularly important in the context of:
    a. supporting emerging technologies - including driverless cars, drones and artificial intelligence - which are likely to require access to specific types of high quality and timely geospatial data and geospatial data infrastructure. Supporting these technologies with access to geospatial data will reduce barriers to business growth and support UK Government investments made through the Industrial Strategy Grand Challenges.
    b. supporting other policy initiatives such as improving access to democracy, housing and planning, or the creation of a beneficial ownership register[19].
5. The rapidly growing innovation in geospatial technology and increasing competition amongst providers of geospatial data means that some of our public sector data stewards will need to adopt new and innovative business models.

[18] https://www.ordnancesurvey.co.uk/business-and-government/products/open-mastermap.html

[19] https://democracyclub.org.uk/ https://mhclgdigital.blog.gov.uk/category/digital-land-services/ https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8259

The Commission should also prioritise data assets that help public sector organisations explore new business or revenue generation models, such as freemium APIs or quality guarantees. We discuss this further in our response to Question 9.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

1. Addresses are part of our everyday lives: they pinpoint where we live and work and connect us to local services we rely on. The Commission should make a register of address data available under an open licence for anyone to access, use and share.
2. UK Government already controls the rights for most UK address data through the OS and Geoplace. In 2015, the ODI ran a project to explore whether it was possible to recreate the UK's address list. We established that, principally due to the legal uncertainty over who holds intellectual property rights in many current sets of address data, it was not possible and that UK Government would have to intervene to make this data available. The final report contains the evidence of value available at the time[20].
3. Subsequently, UK Government started a new £5m project to explore creating an address register. We would recommend that the Commission release the findings of that project to help the wider ecosystem understand the challenges it discovered and where new evidence might be required[21].
4. The Commission should also explore ways in which the UK's address system will need to adapt to changing user needs and expectations. Emerging technologies, such as Connected and Autonomous Vehicles (CAVs) and drones, may require access to sustainable, high quality address data in new ways - for example, the such as data related to landing paths for drone delivery services. The rise of 'floating transport', such as dockless bicycle hire schemes, and alternative delivery locations, such as parcel collection boxes and delivery to car boot, is likely to result in a broader change in the way we consider addresses. This may mean adopting location systems such as Pluscodes[22], in which case we strongly recommended the adoption of open standards to increase adoption and avoid lock-in.

[20] https://theodi.org/project/creating-the-uks-first-free-and-open-address-list/
[21] https://www.gov.uk/government/speeches/geoplace-conference-matt-hancock-speech
[22] https://plus.codes/

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

1. The Commission should ensure that Earth Observation (EO) data collected and maintained by public sector organisations is made as open data for anyone to access use and share.
2. While there are currently over 80 countries with satellites in orbit[23], only a handful of those countries make their satellite data openly available[24]. This is despite the fact that openly published EO data has been shown[25] to drive economic growth, improve societal welfare, expand public and private research opportunities, support innovation, facilitate the education of new generations, and improve decision-making and transparency within government. Where public sector organisations are involved in multinational EO data collection programmes, the Commission should advocate for data to be published to open standards, as openly as possible.
3. Access to EO data will help UK businesses grow skills in, and develop products and services that use, feature detection in different domains, such as agriculture, housing and energy. For example, EO data can be used to tally the number of oil storage tanks in a particular country to produce estimates of consumption patterns and farmers can estimate global crop yields[26]. It can also be used to help human rights campaigners track population flows or environmentalists to track deforestation in remote wildernesses.
4. The Commission should recognise that access to EO data is particularly important during crisis events, such as flooding and fire[27], and that making this data available openly will allow for a faster and more effective response to these crises.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

23 http://www.unoosa.org/oosa/osoindex/search-ng.jspx?lf_id=

24 https://cdn-images-1.medium.com/max/1400/1*K6CYCDP1YXieYF-fzeegOw.jpeg

25 https://www.fgdc.gov/ngac/meetings/december-2014/ngac-landsat-economic-value-paper-2014-update.pdf

26 https://www.afr.com/technology/how-cubesat-satellites-are-changing-the-world-and-your-privacy-20180219-h0wcol

27 https://www.tanka.com/

1. New technologies present opportunities to process and derive insight from geospatial data in new ways.
2. For example, the application of Artificial Intelligence (AI), Machine Learning (ML) and related technologies is making it easier to extract greater value and insights from geospatial data.
    a. These technologies can be used to identify and extract features like road signs, street names and populated areas from images or even videos. For example, Skynet[28] (the machine learning platform of Development Seed[29]), uses machine learning to extract valuable insights from satellite and drone imagery. Similarly, Tanka[30] is using satellite imagery and a suite of AI techniques to detect fires and automate response procedures.
    b. When applied to satellite imagery, companies can use these techniques to automatically detect infrastructure such as roads or electrical lines, identify objects like ships or airplanes, locate important facilities like hospitals or schools and evaluate crop performance or monitor deforestation. At present, many of the organisations leading in this area are from the private sector. In some cases, the commercial firms developing these techniques are working with public sector organisations to tackle pressing, real-world problems. For instance, using computer vision techniques, the Facebook Connectivity Lab[31] and the Center for International Earth Science Information Network (CIESIN)[32] have produced detailed maps of the distribution of buildings and populations in rural regions of 18 countries across the globe. The maps, which the World Bank have described as[33] "unprecedentedly high-resolution", were generated at-scale, and can help governments and NGOs develop a more complete picture of population distribution when combined with information gathered from traditional government surveys and censuses.
    c. When applied to ground-level imagery, on the other hand, machine learning, computer vision and deep learning techniques can help organisations automatically identify important features of the world around us. Google's Street View[34] and Mapillary[35], for instance, use deep learning to extract valuable data like street and business names, addresses and front entrances of buildings from their databases of street imagery. This data can be crucial for delivery companies where knowing the exact entrance of a business or residence can save time and money.

28 https://developmentseed.org/projects/skynet/
29 https://developmentseed.org/
30 https://www.tanka.com/
31 https://code.fb.com/core-data/connecting-the-world-with-better-maps/
32 http://www.ciesin.columbia.edu/aboutus.html
33 https://blogs.worldbank.org/opendata/first-look-facebook-s-high-resolution-population-maps
34 https://ai.googleblog.com/2017/05/updating-google-maps-with-deep-learning.html
35 https://www.mapillary.com/

d. In 2018, the ODI published a report[36] on the array of models being used by organisations to develop AI systems. This included proprietary algorithm models (using a closed algorithm and open data) and open models (using an open algorithm and open data). The report recommended that the sharing and opening of data in ways that secure and safeguard the trust of people will be vital to building, implementing, and operating AI systems.

3. As well as presenting opportunities for making use of existing data more effectively, the Commission should focus on new technologies and approaches that could be used to collect or maintain geospatial data more effectively. For example, it is increasingly easy for organisations to collect geospatial data with low-cost satellites, cheaper LIDAR[37] sensors, and GPS-enabled devices. Meanwhile, collaborative collection and maintenance models can increase quality and reduce costs[38].

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

1. A number of emerging technologies require access to geospatial data infrastructure in their development and adoption. CAVs, for example, require access to a wide range of geospatial data types from different sources[39] including: terrain data (related to elevation and terrain type); network data (such as maps and data about the road network); place data (including points of interest); real-time data (about traffic, construction and other incidents); and sensor data (such as in-car cameras and LIDAR).
2. Access to this data is therefore critical if the UK is to lead in the development and adoption of CAVs and other emerging technologies. This will complement other UK Government investments in these technologies, such as through the Industrial Strategy.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

36 https://theodi.org/article/the-role-of-data-in-ai-business-models/
37 https://en.wikipedia.org/wiki/Lidar
38 https://theodi.org/article/legislation-gov-uk-improving-the-uk-digital-statute-book-through-collaborative-maintenance/
39 https://www.nds-association.org/wp-content/uploads/20180605_NDS_AutonomousVehicleSymposium.pdf

1. The Commission should ensure that public sector organisations are committed to publishing open data and removing the friction caused by restrictive data licences.
2. Like our physical infrastructure, geospatial data infrastructure is owned and maintained by a variety of organisations[40] that span the public, private and third sectors. The stewardship of data infrastructure will continue to evolve in part due to developments in technology making it easier for more organisations to collect and manage data. We agree that "the Commission's Partner Bodies and other public sector organisations must, alongside their core functions, adapt to the evolving geospatial environment and support the ecosystem and market to innovate and grow".
3. We recognise that maintaining this commitment over the long term creates challenges in terms of how we ensure sustainable funding for stewardship and access to data assets from the public sector. These challenges are not unique to geospatial data. For example, national meteorological services around the world are facing similar challenges around how they deliver on a public task which is best supported by openly licensed data[41], whilst ensuring that they can continue to invest in data collection and support use of that data by the widest possible set of consumers.
4. Debates about whether to charge licensing fees for access to public sector geospatial data continue, even when the value of making it open are well documented. Research commissioned by the ODI and completed by Lateral Economics used examples, such as US Landsat data[42], to show that open data will provide an extra 0.5% of GDP than data that people have to pay for[43].
5. The Commission should work with public sector organisations to explore different business models - in particular those that represent alternatives to fees generated through restrictive licensing - that will help to ensure sustainable collection and the provision of access to open geospatial data, such as:
    a. charging for warranties and quality assurance;
    b. charging for support and consulting around use of data;
    c. charging for API access and/or tailored online services to enable on-demand use of data within specific sectors or types of application;
    d. charging for specialised data collection or resurveying of data;
    e. collaborative maintenance and shared curation of data to remove duplication and increase data quality, accuracy and timeliness.
6. The Commission should support debate on the roles of central and local government in maintaining and enhancing our geospatial data infrastructure. There is a wider need for more understanding of whether devolved administrations, city-regions and local authorities in the UK have the right level of powers in the context of data collection, use and sharing. Decisions about data

40 https://theodi.org/article/who-owns-our-data-infrastructure/

41 https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/data-provision/odi-the-state-of-weather-data-infrastructure.pdf

42 https://www.fgdc.gov/ngac/meetings/december-2014/ngac-landsat-economic-value-paper-2014-update.pdf

43 https://theodi.org/article/research-the-economic-value-of-open-versus-paid-data/

should often be made by those closest to the decision; greater devolution for some powers may enable greater democratic involvement, for example through devolved national administrations and city-region mayors. The Commision should explore where, why and which functions or aspects of public sector geospatial data infrastructure should be at local, national and multinational levels and how to ensure appropriate funding at those levels.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

1. No response to this question.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

1. In addition to public sector organisations, the private and third sectors play a role in maintaining and enhancing the UK's geospatial data infrastructure.
2. Private sector organisations such as Google, Microsoft, Apple and Facebook provide mapping services for developers building applications around their respective platforms, making it easier to integrate maps and location data into their products. Google and Microsoft also provide a number of general purpose mapping APIs that provide access to additional features, including routing and business listings. All of the major platforms use a mixture of open and non-open sources to build their mapping services, and many are investing in additional methods of data capture and collection to improve their offering, allowing them to provide not just 2D maps, but 3D models, street view and access to satellite imagery.
3. The proliferation of GPS-enabled smartphones and devices (connected to a global network of GPS satellites) means that it is now possible to capture

information about where people go, how long it takes them to get there and for how long they stay. Companies like Strava[44], a social network for athletes, Garmin[45], a GPS-technology company, and Uber[46], a ridesharing and transportation company, are able to use this location data to generate detailed maps from people's movements. Google is able to collect telemetry data through Google Maps[47] and, depending on user settings, the Android operating system. Telecoms providers collect similar types of data.

a. Data collected by private sector organisations using GPS-enabled smartphones and devices could inform decisions about public transport services, investment in physical infrastructure and much more. City planners and transportation authorities, for instance, argue that they could gain useful insights[48] from the data collected by private sector organisations about how people move through and interact with public infrastructure like roads, tunnels, transport networks, walkways and public spaces.
b. There are already some initiatives underway to make data of this type more widely available to public sector organisations, communities and people. Strava has launched Strava Metro[49], a toolkit available to city planning departments that provides a detailed view of pedestrian and cycling journeys across urban and rural areas. City planners and departments of transportation are provided with subscription-style[50] access to data about routes, wait times at intersections, periods of peak travel and even the starting and ending points of journeys within various regions. Uber[51] has responded to repeated requests from public sector organisations and civil society for access to the data it has collected by launching Uber Movement[52], an online platform that enables analyses of aggregated journey patterns.
c. Paid data-sharing agreements and proprietary tools will not satisfy the demands that all cities have for data[53]. In 2017 New York's Taxi and Limousine Commission introduced rules requiring rideshare and livery companies, including Uber and Lyft, to share detailed data about their passengers' journeys on a regular basis. UK Government and local

44 https://labs.strava.com/
45 https://connect.garmin.com/en-US/features/
46 https://www.inverse.com/article/26156-uber-movement-mapping-app
47 https://cloud.google.com/solutions/scalable-geolocation-telemetry-system-using-maps-api
48 https://www.citylab.com/transportation/2018/01/who-owns-urban-mobility-data/549845/
49 https://metro.strava.com/
50 https://www.fastcompany.com/90149130/strava-the-app-for-athletes-is-becoming-an-app-for-cities
51 https://www.inverse.com/article/26156-uber-movement-mapping-app
52 https://movement.uber.com/?lang=en-GB
53 https://www.citylab.com/transportation/2017/01/finally-uber-releases-data-to-help-cities-with-transit-planning/512720/

authorities have legislated bus operators to open up data after other attempts to persuade them to do so failed[54].

d. By making data as open as possible, private sector organisations can support decision-making and drive innovation. Citymapper began publishing open data in 2017 about its Smartbus routes, stop locations, schedules and real-time arrival predictions. CityMapper was built using open data and the organisation sees the value of releasing their own – it "encourages all transport operators to make their data freely available to enable innovation and accessibility".

e. In some cases, there will be valid reasons why the data cannot be made available as open data, or made more widely available at all – for example, the risk of re-identification of individual people whose journeys are described in the data. As we detailed in a 2018 report, 'Personal data in transport: exploring a framework for the future', journey data is personal data[55]. The journeys people take can be used to infer where they work, shop and live - even where their children go to school. One recent study, for instance, demonstrated that it is possible to identify 95% of people in a dataset using only four spatio-temporal data points[56]. There is an ongoing challenge to find the level of aggregation and/or access that enables data to be as open as possible while protecting privacy and commercial confidentiality.

f. The Commission should explore best practice in terms of increasing access to this type of data and ensure that public sector organisations have appropriate guidance and powers to gain access (such as mandating the publication of open data or data sharing through procurement and licensing/operational conditions for the services they provide).

4. The Commission should support broader debate around the respective roles of public, private and third sector organisations in maintaining and enhancing the UK's geospatial data infrastructure, and the expectations of what types and level of services it could or should provide. The pace of innovation in terms of data collection and analysis creates a risk that private sector organisations may outstrip the ability for public sector organisations to do the same. There is the possibility that commercial sources could supplant or replace public sector data stewards because they provide higher quality data or services that better meet users needs with closed datasets (as evidenced by the widespread adoption of Google Maps). The potential impacts of geospatial data infrastructure becoming controlled solely by the private sector - such as unprofitable parts of the market, or country, being left underserved - should be explored by the Commission.

54 https://www.gov.uk/government/consultations/bus-services-act-2017-bus-open-data

55 https://docs.google.com/document/d/1eBe_hM6lnWf2J_Syco1Gz86fvG7BZpjGF8kNYvw0aaI/edit#

56 https://www.nature.com/articles/srep01376

5. There are ongoing debates about whether nations are receiving an equitable share of benefits from technology and data use, with most focussing on the possible creation of a financial "tech tax"[57]. Governments should also be exploring how to create greater non-financial benefits from large tech firms, particularly given that their size and competitive power means that they can carry a higher compliance burden than other organisations. The Commission should consult on whether public sector organisations should have powers to mandate access, use and sharing of data - in defined ways - held by large firms (perhaps defined as organisations with data about more than 1m UK citizens) for the public benefit. This would be a parallel to the powers that ONS have under the Digital Economy Act to secure data for use in national statistics[58].

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

1. In February 2018, the ODI, in collaboration with a cross-government team, organised and ran four workshops across the UK with geospatial data users. The workshops identified a number of challenges faced by users of OS data, including SMEs and startups, local authorities and other public sector organisations, educational organisations and members of the open data and OSM community[59]. The challenges are similar to those to be tackled by a recently-announced Hydrographic Office project[60].
2. The Commission should continue to engage with data users to support the development of technical remedies or standards to improve the interoperability of geospatial data. These should include:
    a. public sector organisations committing to increase the publication of open data and remove the friction caused by restrictive data licences. Data assets the Commission should prioritise on are described in our response to Question 4.
    b. where data is not available under open licences, public sector organisations developing better understanding of the impacts of non-open licences[61] and working with their community to discuss and clarify licensing issues (particularly in relation to derivative works). New open

57 https://www.bbc.com/news/business-45813754
58 http://www.legislation.gov.uk/ukpga/2017/30/contents/enacted
59 https://docs.google.com/document/d/1AJtrfa93hL4M3TdSy-4LhXJoVLyHeGmiB2vmHyPZYkM/edit?usp=sharing
60 https://www.gov.uk/government/news/uk-hydrographic-office-to-unlock-the-value-of-location-based-information-as-part-of-geospatial-commission
61 https://theodi.org/article/what-are-the-impacts-of-non-open-licences/

data released from public sector organisations may help to unlock other data releases, however increased access to non-open data might exacerbate existing problems unless steps are also taken to simplify and clarify its licensing.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

1. A number of OS products are made available for free use by public sector bodies via the Public Sector Mapping Agreement[62]. We agree that the Commission should "continue the work that was started by Department for Business, Energy and Industrial Strategy (BEIS) to renegotiate the current Public Sector Mapping Agreement".
2. In particular, the Commission should ensure that the geospatial data accessed under the agreement is free from restrictions related to derivative works. Signatories of the Public Sector Mapping Agreement - as other agreements such as as the One Scotland Mapping Agreement, PAF Public Sector Licence and the Aerial Photography Great Britain contract - should be free to create derivative work and release this as open data. This is important to support the goals of public sector organisations, several of which have a commitment to publishing more open data.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

1. The Commission should continue to engage with public sector data users to understand the data assets they could derive benefit from having access to.
2. As well as public sector organisations, the Commission should consider the potential benefits of increasing access to data held by private sector organisations.
    a. As described in our response to Question 11, this data could include data held by organisations that provide provide mapping services and aggregate data collected by organisations using GPS-enabled smartphones and devices.

62 https://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/public-sector-mapping-agreement.html

b. Valuable data might also include locations of services and amenities that the public sector doesn't own or operate, but should know about for planning and statistical purposes, such as food outlets, bank branches and ATMs, pharmacies and nurseries.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

1. The Commission, and the National Geospatial Strategy it will produce, represent an opportunity for central commitment, governance and coordination to strengthen the UK's national geospatial data infrastructure.
2. The Commission should work with devolved national administrations and local government to understand the roles of different layers of government in maintaining and enhancing our geospatial data infrastructure. There is a wider need for more understanding of whether devolved administrations, city-regions and local authorities in the UK have the right level of powers in the context of data collection, use and sharing. Decisions about data should often be made by those closest to the decision; greater devolution for some powers may enable greater democratic involvement, for example through devolved national administrations and city-region mayors. The Commision should explore - and encourage experimentation with - where, why and which functions or aspects of public sector geospatial data infrastructure should be at local, national and multinational levels.
3. The Commission will also need to work closely with other central government organisations and groups in the development of the National Geospatial Strategy. This should include the Department for Digital, Culture, Media and Sport (DCMS) and its team working on the National Data Strategy, Cabinet Office (Government Digital Service), BEIS, ONS, and the Ministry of Housing, Communities and Local Government (MHCLG).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

1. In 2018 the ODI conducted research into the role open data plays in the delivery of public services[63]. The research highlighted three high-level patterns for the ways that open data - including geospatial data - can be used to deliver public services:
    a. using open data to increase access to services for citizens or organisations;
    b. using open data to plan public service delivery and make service delivery chains more efficient;
    c. using open data to inform policymaking.
2. The research also produced a series of recommendations to support greater use of open data to deliver public services. In particular, the Commission should consider the following recommendations in the context of geospatial data:
    a. **Organisational collaboration**. The availability of funding for activity is a key determinant of activity. We received 24 responses to the invitation to tender for the local authority Stimulus Fund aspect of this project - we could have funded more consortia if we had had the resources to do so. There is clearly appetite within local government to undertake experiments in this area but there are funding challenges. The Commission should consider funding further activity in this area to help develop new use of geospatial data and deliver better services to citizens, and also to strengthen peer networks between authorities.
    b. **Data infrastructure, digital skills and literacy.** In the fieldwork, participants referred to the GDS leadership on service design as best practice, such as the curriculum for the GDS academy and the GDS service design manual. As part of the expansion of the curriculum of service design training towards covering data and technology roles and digital competencies, the Commission should consider supporting the development of learning materials specific to the use of geospatial data, including content to help those in non-technical roles understand how open data can support services at a strategic level.
    c. **Peer networks**. Access to environments for networking and sharing best practice[64] across different organisations was deemed essential to developing new ways of using data to deliver public services. The Commission should make use of existing, and where necessary convene new, networks of those who are interested and involved in using geospatial data for public service delivery.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**

63 https://theodi.org/article/using-open-data-for-public-services-report-2/
64 https://theodi.org/method-report-peer-networks-for-open-data-leaders

- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

1. No response to this question.

Q18: Are there any other areas that we should look at as a priority?

1. No response to this question.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

1. No response to this question.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

1. No response to this question.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

1. Some developments we recommend examining for points of comparison and best practice internationally are:
    a. the Australian government's steps to open up a wide range of geospatial datasets and resources. Following the 'Declaration of Open Government'[65] in 2010, the Digital Transformation Agency (DTA)[66] created data.gov.au[67] as a means of finding, accessing and reusing public government datasets, including geospatial datasets. At the time of writing there are over 5,500 datasets[68] from GeoScience Australia alone. In 2014, the DTA launched National Map[69], an online service that allows users to search through a catalogue of geospatial datasets made openly available by public agencies and overlay them on a three-dimensional map of Australia. The following year the Australian government released a 'Public Data Policy Statement'[70] reaffirming and formalising its commitment to making "non-sensitive data open by default" with the aim of contributing to "greater innovation and productivity improvements across all sectors of the Australian economy".[71] More recently, the government has released

65 https://www.finance.gov.au/blog/2010/07/16/declaration-open-government/
66 https://www.dta.gov.au/
67 https://data.gov.au/about
68 https://data.gov.au/dataset?sort=extras_harvest_portal+asc%2C+score+desc%2C+metadata_modified+desc&organization=geoscienceaustralia&q=
69 https://nationalmap.gov.au/
70 https://www.pmc.gov.au/resource-centre/public-data/australian-government-public-data-policy-statement
71 https://www.pmc.gov.au/resource-centre/public-data/australian-government-public-data-policy-statement

PSMA's[72] Geo-coded National Address File (G-NAF)[73] as well as their Administrative Boundaries datasets[74].

b. The European Union's (EU) progress in opening up geospatial data. In 2011, following a string of policies supporting open data[75], the EU published a communication[76] that pledged to open up data as "an engine for innovation, growth and transparent governance" and pointed to geospatial data as an explicit example of the value of open data. The European Space Agency (ESA) has recently received praise for committing itself to opening up some of its satellite imagery[77]. In 2014, the ESA announced[78] that it would provide "free, full and open access" to data from the Copernicus programme[79], including data collected by the new Sentinel series[80] of satellites. The ESA has since launched the 'Copernicus Open Access Hub'[81], an online platform that provides access to data from all current Sentinel missions through both an interactive graphical user interface and an API.

c. The United State's commitment to open geospatial data is the archive of US Landsat imagery[82], which was made openly and freely available in 2009. The global economic benefit of opening up access to this nearly fifty year archive of imagery of the Earth's surface was estimated to be[83] $2.19bn in 2011 alone. These benefits were spread across 38 different primary application areas and stemmed from things like improved long-term environmental planning and monitoring, improved decision making, better enforcement of regulations and increased human safety.[84] Despite commendable gains[85] in the years since the 2009 open data policy was implemented, there is currently uncertainty[86] as to whether this commitment to open government, and by extension open geospatial data, will continue under the present administration.

72 https://www.psma.com.au/about
73 http://data.gov.au/dataset/geocoded-national-address-file-g-naf
74 http://data.gov.au/dataset/psma-administrative-boundaries
75 https://ec.europa.eu/digital-single-market/en/open-data
76 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52011DC0882
77 https://medium.com/radiant-earth-insights/government-satellite-data-and-its-role-in-advancing-global-development-7b6760e803b1
78 https://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Free_access_to_Copernicus_Sentinel_satellite_data
79 https://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Overview3
80 https://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Overview4
81 https://scihub.copernicus.eu/
82 https://landsat.usgs.gov/usgs-landsat-global-archive
83 https://pubs.er.usgs.gov/publication/ofr20131269
84 https://pubs.er.usgs.gov/publication/ofr20131269
85 https://blog.mapbox.com/u-s-government-commits-to-open-mapping-c5341db15842
86 https://sunlightfoundation.com/2018/01/24/under-trump-u-s-government-moves-from-open-to-closed/

2. The Commission should also look for, and learn from, best practice demonstrated by UK organisations and groups in an international context. For example, OSM has become a key component of international geospatial data infrastructure. Local and national governments around the world are working with the OSM community to ensure that their geospatial data is available to that community and the growing ecosystem it supports. Large commercial organisations like Apple, Microsoft and Facebook build OSM into their mapping services[87], and companies like Lyft, Telenav and Mapbox are using it as essential part of their products.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[87] https://theodi.org/article/how-are-facebook-apple-and-microsoft-contributing-to-openstreetmap/

Government launch call for evidence to be geospatial world leader: OSGeo:UK Response

Questions:

Please select which of the following best describes you as a respondent:

Respondent	Please mark with a X
Academic	
Business representative / trade body	x
Central government	
Charity or social enterprise	x
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. Supporting innovation in the geospatial sector, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. Enhancing the UK's geospatial assets, looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. Driving investment and productivity in geospatial applications, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial skills must be general and fundamental, rather than skills in the use of specific software. We note with great concern agreements brokered between commercial software vendors and UK universities and UK Schools to supply proprietary GIS to all students. This stifles education and innovation in the UK geospatial sector.

Free and open source alternatives (FOSS) to proprietary software must be given equal weight in all state-supported education and training, thereby removing financial and licensing barriers to innovation by individuals with strong skills but limited access to budgetary and legal resources.

Much of the current explosion in the uptake of Earth observation (EO) is being led by organisations (specifically start-ups) in the United States and Europe. These companies are doing this through the use, creation and sharing of open source software. If the UK is to become a major player in the Earth observation and geospatial sector then more needs to be done to make UK developers and scientists the creators of open software rather than

just users. Some might argue that the UK has a strong EO sector, but it is way behind in terms of what is currently leading technology as it is too dependent on a slow moving, project-based model. Support for open source, and strengthened geospatial skill development could enhance the position of UK EO.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Given the increasing role of web technologies and version control in facilitating collaborative software development, plus the ability of free and open systems to democratise progress in software development, web-based computing is key to the flourishing of geospatial technologies.

Spatial databases are vital in delivering high quality spatial systems, and the success of open source packages such as PostgreSQL and in particular the spatial extensions PostGIS and PGRouting, should be implemented and promoted by government systems.

Careers in the sector could be promoted by including elements of the geospatial FOSS software stack in the secondary curriculum for geography and computer science. By freeing users from privatised solutions, innovation can be accelerated and the workforce and the workplace will benefit from incremental gains in much the same way scientific progress stems from information and technology sharing.

Many organisations now advertise for positions where a knowledge of and experience in FOSS software is required. Engaging with universities and trade bodies to create nationally and internationally recognised qualifications in open source software would help applicants and recruiters.

Spatial analysis is increasingly moving away from the graphical user interface (GUI) and into the realm of computer science. The Python computer programming language is common to both the leading proprietary and open source GIS software applications, making Python coding skills highly applicable in GIS. The proliferation of the R programming language has spread from the academic environment into the other sectors, with dedicated geospatial functions as well as an expanding library of packages written by the geospatial community. Using programming scripts to process and analyse data makes workflows more robust and reproducible, and the GIS jobs market is demanding programming skills from applicants. It will be important to offer programming skills to current professionals to ensure that they are not left behind recent graduates with recent programming experience.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you

or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The licensing around some Environment Agency datasets such as flood zones is unclear, which means that usage is low. Other datasets such as transport timetables is available in different formats, with different access and licensing constraints across the country, making it difficult to integrate in country-wide solutions. More usage of this data in particular would encourage greater use of public transport.

Other datasets of high value include land ownership and current data on location of underground services in the North Sea, such as pipelines, power cables and telecoms. In general this is still either proprietary or “as-planned”, and now out of date

A large number of environmental datasets are made available only for non-commercial use. Climate change related datasets, hydrology and soils data would all be valuable if made truly open data.

Several environmental datasets are not accessible to the Third Sector. Such datasets include the Centre for Ecology and Hydrology (CEH) Land Cover Map Vector data, the Cranfield University NATMAP Vector data, the rural Land Registry field margins and the Rural Payment Agency data on Agri-Environment Schemes, which are subsidised by the taxpayer. Licences for these datasets treat non-profits as businesses when they should be treated akin to academic research institutions for which the data are more readily accessible. This is particularly pertinent when charities are working to help the government achieve its own commitments, for example under international treaties such as the Convention on Biological Diversity and the Sustainable Development Goals.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data and standards must be fully open (see https://www.owenboswarva.com/blog/post-addr2.htm for a summary of the current situation). Proprietary solutions such as What3Words should not be promoted as alternatives. They cannot be relied upon to be sustainable in the long-term as they are closed source.

Address Base data should be made more easily available, to enable applications to identify UK properties beyond the front letterbox, which is as far as postcode address file currently reaches.

Open and up to date information on the location and collection times of post boxes would be an extremely useful dataset. The ability to query this information through a web (or

voice-enabled) interface would be extremely valuable, particularly to at risk or elderly people.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The global Earth observation sector is rapidly changing, and those organisations that are deriving most benefit are using open data and open source software. UK universities have been too slow to react to this, and more graduates are required who understand the interface between IT and Earth observation science, and have a better understanding of, and desire to code. Vast amounts of open data are now available, but future development in the sector will depend on creating applications for time series data and having the knowledge to understand how best to manage and deliver those data.
The commission could help link education establishments and SMEs (a wide range of SMEs rather than the usual players) to create and deliver (in tandem) course content that would result in a young labour force with desirable, transferable and much required skills. A commission-sponsored degree and/or professional certificate would, if properly implemented, demonstrate a commitment to growing and enhancing geospatial skills in the UK. Open source software should be a key component of all future courses.

The availability of free and open earth observation data is critical to the development of this sector.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission could focus on the accessibility and availability of the geospatial datasets as outlined above, which would enable SMEs, Charities and Academia to focus on the development of the technologies and provide the economic growth. Additionally, focusing on the promotion of FOSS software would be valuable across the board rather than specifically to one sector or another.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The example of AddressBase going open is a good example of how commerce can better find and complete the addresses of their customers.

Further development to intelligent transport routing, which uses geospatial information to re-route road traffic to a greater extent, may improve performance of road infrastructure.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Open licences could enable public servants to develop public software collaboratively and enhance their communication with each other and vendors, rather than filtering their requirements, communication and finances through legacy vendors who run large legacy systems that currently dominate government geospatial applications (such as in proprietary development management solutions).

By opening, and modularising geospatial systems, smaller vendors may be able to provide smaller solutions that contribute to, and maintain, public service solutions as platform type solutions rather than vendor-specific monolithic software architectures.

Long term plans for investment in and support of open solutions would be beneficial - too many platforms have received funding for development but no longer term funding for implementation, which is wasteful of finite resources and fails to demonstrate some of the excellent open source work being undertaken in Government.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

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Remain a member of the existing European GPS network. Creating our own (a Brexit proposal), would be a colossal duplication of effort and hence a massive waste of money.

A small firm called wayfindr is trying to develop a standard for indoor navigation based on radio beacons for helping people move around large public spaces such as train stations.

If an open standard were agreed, this could create an opportunity for small vendors to contribute to its development, rather than rival companies trying to promote their own patented solution and aggressively compete for market share, which could end up with different beacon systems being used in different train stations for example.

https://www.wayfindr.net/open-standard

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector could be encouraged to contribute to open datasets and solutions in contracts. For example, they could contribute to an open AddressBase geocoding solution, which will be of benefit to them enabling the geolocation of their customers' homes with greater accuracy.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Adoption of open licences
- Removal of rate limits etc
- Simplify discovery by reducing the complexity of data stores or portals: often a list of dataset addresses is all that is required
- Web/mobile developers tend to prefer latitude and longitude for data and web mercator for tiles, yet many systems record spatial information in british national grid, a developer-friendly reusable shared solution to reproject between coordinate systems may improve the link between data and frontend development

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By promoting and improving standardised data formats, for example in the recording of planning records, or indeed any public service data that includes geospatial information and making metadata on their datasets readily available.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

High resolution, frequently updated satellite and aerial imagery
A coordinated involvement in OpenStreetMap, helping to improve their data?
Detailed soils data

Question 15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

By taking the government as a platform approach to centralisation (standards, coordination) and localisation (implementation, inter-communication)

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Promote the need for spatial professionals (either through experience or qualification) at all levels including managerial
- Open standards
- Open licences
- Providing opportunities for public servants to collaborate on shared solutions
- Providing opportunities for small vendors to contribute via standardised record management (i.e. open standards for service delivery systems)
- Simplified procurement for SMEs and a move away from always using larger commercial organisations

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would

particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

See Q2 above: levelling the playing field in education for spatial applications between proprietary and open-source

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- By supporting an excellent spatial event such as FOSS4G
- By innovating open standards (see Open311 for example, which was founded by Code4America and is now used internationally, including for fixmystreet's own middleware to improve the british public space)
- By hiring innovative organisations, ideally in groups rather than single vendors to deliver high-profile government geospatial solutions, and allow those innovative organisations to flourish and collaborate

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- New York City planning labs (https://medium.com/nycplanninglabs/nyc-planning-labs-one-year-in-1f4c8cbd73aa)
- Philadelphia analytics (http://analytics.phila.gov/)

[Text redacted]

Geospatial Commission
Cabinet Office
1 Horse Guards Road
London
SW1A 2HQ

24th October 2018

To whom it may concern

Re: National Geospatial Strategy – call for evidence

Thank you for the opportunity to respond to this consultation. OpenStreetMap United Kingdom (OSM-UK) is supportive of efforts to drive the move to use public and private sector geospatial data more productively. We believe that the global, open and collaborative nature of the OpenStreetMap project has a pivotal role to play in unlocking extra value for the economy every year.

Our vision is one in which access to geospatial data is universal and where barriers that prevent individuals or organisations from using, innovating with, and delivery value from geospatial data are fully removed. This vision can be delivered via greater collaboration and openness. We therefore welcome all opportunities to work with the commission, the geospatial industry and the OpenStreetMap community to resolve current issues and to help us realise this vision.

About us

OpenStreetMap United Kingdom (OSM-UK) represents the interests of the OpenStreetMap community in the United Kingdom, the Isle of Man and the Channel Islands. Our members contribute to, are users of, or otherwise have an interest in, the OpenStreetMap project.

The OpenStreetMap project was founded in the UK in 2004, with the goal of creating an openly licensed map of the world. It has subsequently grown to become one of the most successful collaboratively maintained open datasets in the world. This success has meant that OpenStreetMap has become part of the global geospatial data infrastructure and is supported by a rich ecosystem of individuals, community groups, small businesses and multinational organisations.

As a not for profit community interest company, we are delighted to be able to support our community and we will strive to be a leading player within the OpenStreetMap project. We aim to:

- Increase the quality and quantity of data about the UK in OpenStreetMap.
- Improve and increase the size, skills, toolsets and cohesion of the OpenStreetMap community in the United Kingdom.

- Promote and facilitate the use of OpenStreetMap data by individuals and organisations in the United Kingdom.
- Promote and facilitate the release by organisations in the United Kingdom of data that is suitable for use in OpenStreetMap.

Our relationship to the OSMF

The OpenStreetMap Foundation (OSMF) is an international non-profit organisation supporting but not controlling the OpenStreetMap project. Although the OSMF is also a company registered in England and Wales, it's scope is global.

We became a Local Chapter of the OpenStreetMap Foundation (OSMF) in 2017. The agreement established a framework of mutual support and recognised that OSM-UK will represent the interests of the OpenStreetMap community within our designated geographic region as defined above.

Earlier this year OpenStreetMap Ireland officially formed as a company limited by guarantee. We understand that they are also interested in becoming a Local Chapter of the OSMF, likely covering the Island of Ireland. We have therefore consulted with OpenStreetMap Ireland in regards to our comments on Northern Ireland geospatial data. We will continue to work together on ensuring the best outcome for Northern Ireland's geospatial industry.

Response to the call for evidence

Please find our response to the call for evidence below. As noted above we welcome all opportunities to work with the commission, the geospatial industry and the OpenStreetMap community to resolve current issues. Please contact us via [Text redacted]as a first port of call.

Your sincerely,

[Text redacted]

[Text redacted]OpenStreetMap United Kingdom C.I.C

Geospatial Commission: Call For Evidence Response Questionnaire

About you and your organisation

Name	[Text redacted]
Organisation	OpenStreetMap United Kingdom C.I.C
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	Members' organisation

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We are broadly supportive of your view of geospatial data types. As noted in your call for evidence, the importance and demand for geospatial data is constantly evolving. The data and norms in place today are likely to be complemented by new data and processes in the future, some of which may not yet have even been conceived. We therefore support a wide-ranging view of geospatial data types noting that some of these are easier for the private sector to survey/measure (e.g. location of physical assets detected via advanced image recognition and commercial satellites), whilst others are more abstract or represent a legal or political construct defined and controlled by a public sector body (e.g. areas of land with a legal status, political and administrative boundaries, address data). Any National Geospatial Strategy should focus on unlocking elements that are not as readily available to the private sector.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Data collection and data ownership.
Whereas in the past geospatial data has been the focus of public sector organisations (e.g. Ordnance Survey) who control the collection and rights ('ownership') of data, this is beginning to change and this is likely to accelerate in the future. Supporting geospatial skills related to data collection will ensure that the most value can be extracted out of techniques such as remote sensing, LiDAR, image recognition and crowd sourced (Volunteered geographic information). Training on data rights, ways to share data (formats, systems and licences) and appropriate business models for data will ensure frictionless movement of geospatial data between individuals, organisations and the public sector.

Schools and academia
Thinking about schools and academia, it is essential that the next generation are exposed to as wide a view of geospatial data as possible. The existing system focuses on traditional public sector data. This should be broadened to include data and experience from the private and volunteered geographic information sectors. Evaluating appropriate data sources and tools for each project, are skills that are valued in all sectors and so setting up the next generation with these skills and higher view across the sectors will equip them far better than focusing on a single provider's offerings.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Firstly, understanding of data rights ('ownership') and licensing. This is particularly true of public sector data which can often be the output of complex chains of data processing involving multiple parties (e.g. local authority data which has not been wholly created by the local authority and may include the intellectual property of other bodies such as Ordnance Survey and Royal Mail). A good understanding of rights and licensing is often required when wanting to use this data. The system should be simplified so as to remove the skill barrier.

Secondly, data analytics and computer science. As larger volumes of data become available, and new techniques of data collection need to be developed, having the right analytical and computer science skills will become increasingly important.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

Address data
This is a key area and we cover it in detail in our answer to question 5.

Ordnance Survey data
Whilst we are pleased to see steps to open up access to Ordnance Survey data under the Open Government Licence (OGL), we feel that this does not go far enough. In particular we are concerned that the plan to release some data "for free, up to a threshold, through an API" will result in continued barriers to access which could be avoided. We prefer a solution where all data is made availble (without threshold limits) under OGL. The commission and Ordnance Survey should explore appropriate business models that will enable this.

Planning and local highways/Street data
Planning, transport and street data held by Local Authorities plays a key role within our society, yet continues to be hard to access. Release of this data both at source and aggregated via a central hub, under an open data licence will support innovation and enhance democratic processes within the United Kingdom.

Within our answers to this consultation, we cover topics which, if implemented, will ensure maximum value of this data. This includes (1) publishing data which is joined together as a UK wide dataset and published on central hubs, (2) frequent updates or publishing "as live" via an API, and (3) collaboration with the end users and Volunteered geographic information sector.

As an example, the National Street Gazetteer (NSG) is regularly updated by all 174 highway authorities via a central hub (GeoPlace in this instance). This data should be made available via a full download extract and an API and should be under an Open Data licence. Functionality should be added to allow collaboration with the wider industry (e.g. initial centre lines could be provided by the construction industry, and potential errors could be flagged by all parties).

Excessive redaction of data
The Commission should ensure that national security and national critical infrastructure considerations are not used excessively or unilaterally to redact data releases. As an example, our members have been prevented from receiving locations of fire hydrants (despite them being entirely visible on the ground) and we feel that this is excessively restrictive. Knowledge of fire hydrant locations is not only beneficial from a safety perspective, but may also be of use in the insurance sector.

Natural monopolies
Private sector organisations which are natural monopolies (or can be considered as running an essential public service) include the utilities, rail and bus service, the Royal Mail amongst others. Many have access to rich geospatial datasets, which if made available as open data, would allow for greater innovation in key

industry sectors. There is little incentive under current regulatory frameworks to make this data available, let alone available as open data. The commision should explore the value of making this data more available, especially for those industries that are pivotal to other government strategies (e.g. utilities and public transport data can support the Clean Growth Strategy).

Licensing of private sector data
The introduction of the Open Government Licence for publicly held data has helped to increase the amount of open data being made available - held back now mainly by complex chains of data rights (IP on derivative work).

Our members continue to face challenges in the private sector. A government led standard waiver for private companies to publish their data would help. A very small example is retail store locations. Although it is possible to scrape this data from websites, the legal situation of doing so is unclear. Our members prefer to get explicit permission but this can be challenging with some companies misunderstanding that publicly accessible does not equate to open data.

Privatisation or oursourcing of public services
Finally, for data that is currently publicly held, the Commission should ensure that this remains accessible under an open licence in situations when public services are privatised or outsourced. Examples of where this has not been the case include the privatisation of Royal Mail and the use of infrastructure support service providers to maintain Local Authority street assets (street lighting, benches, etc).

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The country's postcodes are commonly used as a pseudo-identifier when matching positional data from different sources. We agree with the commissions observation that it is “the most commonly recognised form of an address by the public”. For emerging technologies to succeed it is likely that they will need to gain the support of the public. As such we believe that initial focus should at first be on providing greater and more frequent access to postcode and PAF data under an open data licence. It is our view that the PAF is a specific geospatial database and is included in the commission's view of geospatial data types (Question 1). Unlocking access to PAF will also ease the route to the open data release of the National Address Gazetteer; something which we are keen to see as soon as possible.

An additional and valuable first step would be the immediate release of Ordnance Survey’s “Code-Point with Polygons” data under an open data licence. Our members have identified a number of errors with the existing “Code-Point Open” dataset, often related to the introduction of new postcodes. A monthly release (or more frequently / as live) would help to ensure that corrections are published with less delay.

In Northern Ireland the Central Postcode Directory (CPD) maintained by NISRA, and Pointer (the address database) maintained by Land & Property Services (LPS) should be released as open data.

Furthermore, the recent trend in public sector (gov.uk) registers to provide address data only as a UPRN, must be stopped until the relevant UPRN data is also made available under the OGL. Since the public don't have access to the database that decodes these into full addresses, providing address data only as a UPRN removes much of the usefulness from address-containing datasets that are converted to registers. We believe it should be a requirement to have an openly licenced address register containing those UPRN records that appear in other gov.uk registers. A true open national address database is a must.

Thinking longer term, the rise of ‘floating transport’ (e.g. dockless bicycle hire schemes) and alternative delivery locations (e.g. parcel collection boxes, delivery to car boot) is likely to result in a change in the way we consider addresses. Ensuring that our systems are flexible enough to adapt to this change is important and will act as an enabler to new service offerings.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

To help support an effective market, the commission should look towards existing solutions that facilitate the sharing and discovery of existing earth observation data. As an example, the Open Imagery Network [1] enables contributors to share imagery and associated metadata. The resultant discoverable network of openly licensed imagery, helps to ensure that earth observation (imagery) data is available to a wide range of organisations.

We believe that openly licensed data aids an effective market and therefore, when data is collected for a publicly funded project, there should be a presumption that this data be made available under an open licence.

As drone imagery is often better than satellite imagery when a high resolution is required, the Commission should consider how best to support low altitude solutions as well as satellite technologies.

[1] https://openimagerynetwork.github.io/

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Technologies related to improved publication of geospatial data should be investigated. A move towards more collaborative working practices will ensure that public sector data can be more widely exploited. Our answers to other questions include suggestions that public sector data should be (1) joined together as a UK wide dataset and published on central hubs (e.g. GeoPlace), (2) updated on a more frequent basis or published “as live” via an API, and (3) should allow for collaboration with the end users and Volunteered geographic information sector. The commission should focus on technologies that make this possible.

More broadly, the commission should focus on those new technologies that are open and collaborative. This will ensure maximum use and ensures that any public expenditure is to the benefit of the wider economy rather than a small subset of the industry organisations.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data could be used in the decision making process about future technologies (e.g. deciding the best locations for Mesh WiFi on lamp posts, 5G rollout, electric vehicle charging point). Ensuring that as much data is open for anyone to use will allow innovation to flourish, rather than be stilted by lack of information.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Greater Cooperation
Public sector organisations should look towards more collaborative working practices. This includes within the public sector, but also greater collaboration with the private sector and Volunteered geographic information (VGI) community.

If we take public rights of way as an example, we can consider two separate stages - the maintenance of a record of the legal status of rights of way, and data about the condition of the rights of way.

Firstly on recording the legal status. As it currently stands, the record of a right of way’s existence is maintained by county-level councils, so there are over 100

different datasets, all in slightly different formats. Greater collaboration between local authorities would ensure that best practice is more widely adopted and that data formats are standardised. It would also ease the process of releasing this data as open data which some local authorities have actively pursued whilst others have wasted time on resource on fighting (and losing) FOI/EIR requests. Specifically on the point of releasing the data as open data: Local Authorities are required to submit their Rights of Way data to GeoPlace as part of the Local Street Gazetteer submissions. A collaboration whereby GeoPlace are responsible for releasing more open data would reduce the overhead incurred by each Local Authority acting independently. Note: to date GeoPlace have refused to provide access to this data, even though it would benefit their Local Authority joint owners.

Moving beyond the basic level information about a right of way, there is additional metadata that can be collected. This includes attributes such as the condition of the right of way, any obstructions and ease of access to users with reduced mobility. The trend over recent years has been to reduce the number of Rights of Way Officers employed by the public sector. Greater collaboration with the private sector and the VGI community, will ensure that this additional metadata can be collected at low cost to the public sector.

Also see: opendata.esd.org.uk which may help to unify data formats.

Rethinking how data is published
Public sector organisations need to move beyond issuing static one-off snapshots of geospatial data and issue more periodic updates and eventually stream changes continuously or offer API access.

Data is much more useful if it's available country wide so public sector organisations (in particular Local Authorities) should explore combining their data and publishing on central hubs as a single dataset. We envisage a similar mechanism to how local authority food hygiene rating data is combined online [1] and note that for geospatial data this is already occurring to some degree via GeoPlace (although not published).

[1] http://ratings.food.gov.uk/

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No comment provided.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Use of the private sector to develop the underpinning infrastructure and to enhance geospatial data assets should be considered on a case by case basis.

As noted in our answer to question 4, the Commission should ensure that public sector data passed to the private sector (and more broadly any project supported by taxpayers money) remains accessible under an open licence in situations. This includes both outsourcing of work and privatisation of public sector organisations.

Examples of where this has not been the case include the privatisation of Royal Mail and the use of infrastructure support service providers to maintain Local Authority street assets (street lighting, benches, etc). Both of these have led to less access to key geospatial data.

Private sector organisations that digitise historic datasets and maps should not be able to claim copyright on the digitised copies.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Licensing continues to be a major challenge that our users face. This is especially true of data created by public sector bodies who are signatories of the Public Sector Mapping Agreement. The mixed source of their data makes it more challenging to release open data and our members frequently find that local authorities are unwilling to spend the time to understand licensing. This complexity (both perceived and real) is used as a barrier to restrict the release of data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission should ensure that geospatial data is free from restrictions particularly related to derivative works. Signatories of Public Sector Mapping Agreement, the PAF Public Sector Licence and/or the Aerial Photography Great Britain contract should be free to create derivative work and release this as open data.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The public sector should be encouraged to fully explore what data may be of interest to them in better delivering their services. This should not be limited to just the data of the other partner bodies or other public sector bodies. A full exploration of all data, including private sector data and VGI datasets (such as OpenStreetMap) should be undertaken. Stimulus funding should be provided to allow (and actively promote) innovation with the public sector.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

No comment provided.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Coordination between Local Authorities is a topic we touched upon in our answer to question 9. Please see our answer to that question. Additionally, the Commission should support the concept of central hubs for combining datasets that are maintained by individual local authorities. Data is much more useful if it's available country wide in a single download/API. Food Hygiene Rating Scheme (FHRS) data is a good example of where this is happening already. Public Rights of Way is half-way there with the collation by GeoPlace; they just have to publish it!

To facilitate effective coordination Local Authorities must also be supported to engage in knowledge sharing forums, with stimulus funds available to further innovate and engage with the geospatial industry. Efforts should be backed up with engagement and promotion at a senior level to ensure that geospatial data and analysis is recognised as a high value asset to Local Authorities.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The number of applications of geospatial data are limitless with existing applications representing just the start of the possible. The OpenStreetMap project has demonstrated how a crowd-source and collaborative approach can play a central role in the geospatial industry. Since its creation in 2004, OpenStreetMap has been creating and supporting jobs in the UK and globally.

Our members are ready to support the innovation and development of new geospatial applications. Many employees of the geospatial industry will have a direct or indirect experience of OpenStreetMap. We have recently started a UK Talent Directory for those who wish to work on projects that involve / incorporate OpenStreetMap. From teachers, to developers, to artists, we look forward to continuing to support existing and potential geospatial applications identified by this consultation.

Q18: Are there any other areas that we should look at as a priority?

No comment provided.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comment provided.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The Geospatial Commission should consider where target funding can best be utilised to support the public, private and voluntary sectors on the global stage. Support of the academic and fledgling business community will help to keep the United Kingdom at the forefront of the international geospatial world. Opportunities to attend and present at global forums should be investigated. We should aspire to host global forums and be thought leaders at the cutting edge of the geospatial data industry.

Furthermore, the Geospatial Commission should be proud of the work delivered, not just by the public and (for-profit) private sector, but also the achievements of the volunteer and non-profit sector. They should champion this on the global stage to encourage inward investment and skill growth. Recognising the special economic circumstances of the volunteer and non-profit sector, the Commission should tailor solutions to ensure that all sectors (public, private, non-profit and voluntary) move forward together.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We believe that the global, open and collaborative nature of the OpenStreetMap project has a pivotal role to play in unlocking extra value for the economy every year. OpenStreetMap has grown to become one of the most successful collaboratively maintained open datasets in the world. This success has meant that OpenStreetMap has become part of the global geospatial data infrastructure and is supported by a rich ecosystem of individuals, community groups, small businesses and multinational organisations.

This page [1] sets out some examples of collaboration between the public sector and the OpenStreetMap project. The examples are global in reach and demonstrate the benefits of greater collaboration and openness.

The UK should be looking to be an international leader. OpenStreetMap Ireland have made us aware of a bad example from Ireland in the recent introduction of the Eircode (Postcode), where the data is proprietary, but individuals are only allowed five searches per day. It is also unclear how the information learned in those searches can be shared. During the debate prior to the introduction of Eircode the private ownership of the British postcode system was used as an international example for this policy. This highlights that, whilst it is always useful to look for points of comparison overseas, findings should be tested with the UK geospatial industry and that the UK should seek to raise the standard higher.

[1] https://wiki.openstreetmap.org/wiki/OpenStreetMap_for_Government

ORDNANCE SURVEY

Response to the Geospatial Commission National Geospatial Strategy – call for evidence

OFFICIAL

October 2018

Ordnance Survey

Contents

Ordnance Survey (OS) is the National Mapping Agency for Great Britain, and a world-leading geospatial data and technology organisation. As a reliable partner to government, business and citizens across Britain and the world, OS helps its customers in virtually all sectors improve quality of life. OS expertise and data supports efficient public services and infrastructure, new technologies in transport and communications, national security and emergency services and exploring the great outdoors. By being at the forefront of geospatial capability for more than 225 years, we've built a reputation as the world's most inspiring and trusted geospatial partner.

Introduction

Data is the fabric of the UK economy, and location data is the thread that ties it together.

Everything happens somewhere; location data – describing people, places, objects, or events – both underpins the economy and is a by-product of the number of new technologies connecting our streets, homes and businesses.

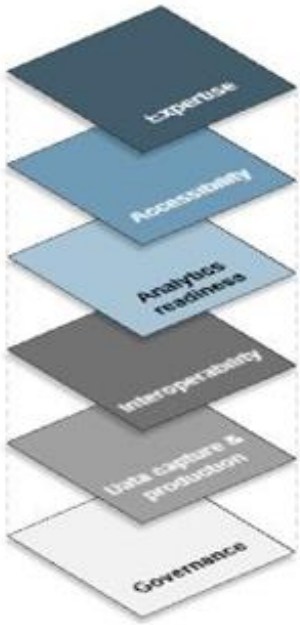
Location can also be the simplest unifying component, joining together multiple perspectives of the real world. Information about physical assets and people, historic and real time can be manipulated to determine problems and define and measure appropriate services.

Whether it is gathered by a surveyor using highly-accurate equipment on site, or crowd-sourced from millions of mobile phones, better use of location data could unlock £6-11bn of value for the UK economy.

Ordnance Survey (OS) is a global leader in the creation and maintenance of geospatial information, second only to the US in the World rankings in the GeoBuiz Report *Geospatial Industry Outlook & Readiness Index 2018*. We produce an authoritative, consistent register that captures all 243,241 sq. km of Great Britain to centimetre accuracy, forming a core data asset on which both the public and private sector rely.

Our response to the National Geospatial Strategy Call for Evidence draws on our 227-year history as the National Mapping Agency for Great Britain, as well as our experience working on today's cutting edge of data collection, curation and analytics. With over 400 commercial partners and more than 5000 users across the UK and internationally, we are working with the users and providers of geospatial data and services every day, responding to their requirements and changing to meet their future needs.

Unlocking the value of geospatial information will require investment and coordination across six distinct layers of the geospatial infrastructure. (LEK, 2018)



Description	Required improvements
• Specialist knowledge of how to apply and extract insight from GI	• Development of intellectual capital (e.g., into new areas such as machine learning) and more constructive advisory relationships with users (e.g., cultivating start-ups)
• Ease with which geospatial data can be accessed and shared	• Common licensing frameworks and access platforms (e.g., open APIs and simplified web access)
• Ease with which geospatial data can be deconstructed, scrutinised and analysed	• Re-structuring of data and metadata (e.g., providing platforms for analysis of geospatial data) and improving data currency
• Extent to which geospatial data is compatible with other data and systems	• Development of common standards and schema across geospatial domains (e.g., adoption of common geospatial identifiers)
• Capture, extraction and subsequent maintenance of geospatial data	• Higher volumes of data with more detailed features (e.g., street furniture, building attributes)
• Creation of geospatial policy and standards	• Greater engagement by all relevant stakeholders across government and UK plc (e.g., to make more government geospatial data openly available)

As the Geospatial Commission forms, it will need to make strategic decisions to relieve 'upstream' constraints – data, interoperability, analytic readiness – as well as targeted interventions in particular sectors and emerging markets to stimulate and promote 'downstream' use of geospatial data and to release the associated economic and social benefits.

We firmly believe in the need for ambitious National Geospatial Strategy, focused on the need for clear policy leadership, and prioritisation of demand and investment. The Commission will have to balance the need to serve today's users while fostering new technologies, emerging use cases for geospatial data, and our international position, to ensure that we are building the infrastructure to enable the fourth industrial revolution.

It is important to recognise that geospatial information is rarely the only answer – its real value emerges from the interoperability with different data sets. The same will stand for the National Geospatial Strategy. It will need to recognise the overlap of ambition and value with the other major government strategies – the Industrial Strategy, an emerging National Data Strategy, and others.

OS has the insight and experience to help inform a new National Geospatial Strategy on the role of location data in emerging use cases, including autonomous navigation, the Internet of Things and underground assets. The Commission may also have a role to play in helping focus cross-government efforts on Earth observation data. Any strategic investment and policy coordination should focus on meeting user needs with the right information at the right time, building a single chain of geospatial information which is fit for purpose.

We also recognise the value of a broader, needs-based focus for skills development in geospatial data and geography. Individuals who can use location effectively as one element of complex problem-solving will be highly-prized in a data-enabled economy. Our geospatial community in the UK is already one of the strongest in the world, and it is important that we recognise the value that geographic insight can bring to the wider data skills needed by the future economy.

OS stands ready to support the Commission, as a partner body and as the National Mapping Agency for Great Britain. As experts in our field, we are excited by the opportunity which location data brings in both the public and private sectors. The creation of a Geospatial Commission for the UK recognises the critical opportunity just ahead – the chance to foster the strongest, most connected digital economy in the world.

Our response references a number of supporting case studies which show how OS geospatial data is helping tackling cross-cutting challenges – please find these in *Appendix one*.

We have also included a list of suggestions for additional reading at *Appendix two*.

The Emerging UK Geospatial Strategy

Q1: Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

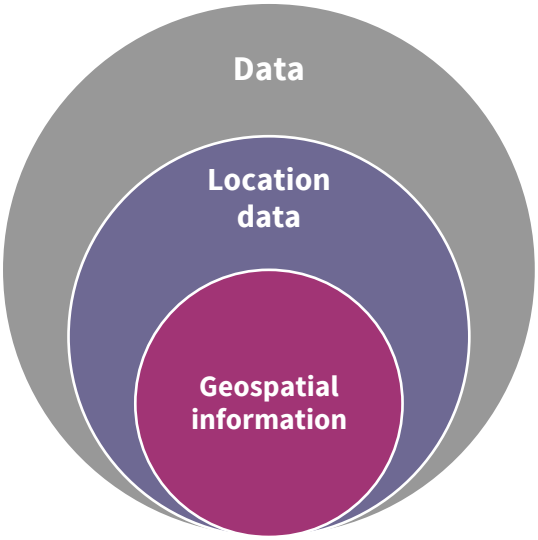
Regarding the first two definitions, OS notes that the distinction between geospatial data and positional data appears to relate to the *purpose* of the data. This is not intrinsic to the data itself (essentially both categories have a direct or indirect location, and a variable number of attributes). Data can have more than one purpose – intentional or not. Hence these two categories are not distinct and their potential use is not clear.

Geospatial data itself Is wider than place-based or topographic data and might include: subsurface geological layers; topological networks such as rivers and roads; or the shape of Earth's terrain.

The third definition of 'geospatial identifiers' can be determined, and we have no comment.

The fourth is a 'service' but speaks of insights and products. The distinction between this and the first two is also unclear.

If the Commission wishes to continue to use these terms, then some clear examples would assist understanding.



Although it is not stated as to the purpose of these categorisations, we note that for the purposes of the Commission, it may be useful to draw some form of sub-categories of geospatial data, whether that is for commissioning services, to establish the scope and remit of the Commission within Whitehall, or to create useful links with other policy areas.

To achieve this, we suggest that there are existing definitions which might assist. The International Standards Organisation (ISO) defines 'geographical data' and 'geographical information' in *http://www.isotc211.org/TC211_Multi-Lingual_Glossary-2016-06-28_Published.xls*. Although ISO uses the word 'geographical' rather than 'geospatial', these definitions are widely used and appropriate. Further categorisation will depend upon the Commission's objectives.

The UN has determined a 'minimum list' of fundamental geospatial data themes. See *http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/E-C20-2018-7-Add_1-Global-fundamental-geospatial-data-themes.pdf* for the list and short description of these themes.

Theme 1: Supporting innovation in the geospatial sector

Q2: In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

There are also specific geospatial skills in which we recommend that the UK must *retain and enhance* capabilities. Our geospatial community in the UK is already one of the strongest in the world, and it is important that we continue to nurture these foundational skills to support our ambitions. The following are core to the continued delivery of user needs today:

- Geospatial Enterprise Systems
- Geodesy
- Global Navigation Satellite System (GNSS), Global Positioning System (GPS) and Geoids
- Earth observation
- Satellite and aerial imagery capture and processing
- Photogrammetry and land surveying, including: laser scanning, point clouds, and underground assets
- The collection, interpretation and management of crowdsourced data and Building Information Management (BIM), including data quality and provenance

The professionalisation of geospatial skills is important to ensure that practitioners are viewed on a similar level as their counterparts in, for example, the engineering field. Geoscience degrees deserve continued government support. Government has recently started to create a 'Geography' specialism, as part of the Government Science and Engineering Profession, which would benefit from the Commission's support.

But geospatial skills should be a specific component of a wider data and IT skills landscape, with a focus on data architecture, engineering, modelling, management and governance. Skills which enhance data standards and data quality, enable interoperability and security, and can create new software intellectual property will be critical. Examples include:

- Collaboration and linking of multiple technologies and data sources
- Data analytics skills, which are fundamental to the continued relevance of geospatial data; analytic and predictive modelling, scenario planning, risk and impact assessment, coupled with data science, machine learning and citizen science, increasingly important to enabling society to realise the full benefit of geospatial data
- Developer, software architecture and digital engineering, including data visualisation, augmented reality, gamification, are increasingly relevant alongside user experience design. These skills enable an accessible, real time, intuitive and scalable means of accessing, integrating and serving data
- Geographical understanding and interpretation of data to produce spatially coherent decisions
- Ensure the topic of data ethics thinking is included as a skill to build trust and upfront consideration of the use of the data.

Q3: What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a challenge in recruiting on the data side for Data Architects/modellers, Data Management Specialist (Data standards, metadata, etc.) and IT development and engineering capabilities into OS as 'geo' can be viewed as a niche industry. To tackle this, we undertake a range of actions, outlined below, and supplement that programme by positioning our employer brand to emphasise the innovative digital nature of geospatial engineering.

Talent development programmes

OS has designed and runs its own IT Trainee programme so that we may more quickly contextualise engineering skills within a geospatial environment. While the languages we use, and to some extent operating environments, are not hugely different, their application in a geospatial context is more tailored. To support people as future 'data leaders', we use staff capability plans, individualised learning and development plans, which identify current skills necessary to deliver today's projects, and those skills which will be required in the future.

OS is continuing to grow its capability in data science and analytics. In previous years, we have invested in data science graduates. We note that data science and AI are increasingly coveted areas of expertise. Our learning from previous graduate schemes is that OS – and the wider geospatial sector – is generally not considered to be a career choice; students tend to be unaware of geospatial issues, unless they have previously studied subjects like Geography.

In 2018/19, OS is designing and trialling (with an internal talent pipeline) a multidisciplinary geospatial graduate development programme which will immerse graduates in all aspects of essential geospatial capabilities: core data collection and maintenance; developing technologies (e.g. machine learning, sensed data); data analytics and modelling; core engineering; technical consultancy; technical product/data ownership; and innovation. During this programme, individuals will also undertake modules and masterclasses in wider business skills, including: business modelling and planning, finance, stakeholder management and HR. The graduates we recruit over the course of this year will then participate in the above programme.

Skills development collaboration

The sector has fundamentally changed: we have had to invest time and effort to connect with the disciplines which have relevant capabilities, namely maths, physics, computer science, and data science. It is no longer as necessary as it once was to be a geographer or geospatial data expert. To support work which is already underway, the IT and geographical sectors should collaborate on large-scale campaigns to promote career opportunities in the geospatial sector to a broader range of disciplines.

OS continues to support education and research with teams working in collaboration with the education sector and spanning primary and secondary education through to Degree, Masters and PhD programmes along with Knowledge Partnerships in conjunction with a number of universities across the UK.

For examples of programmes where OS is working in partnership to broaden and enhance geospatial and related skills, we refer the Commission to:

- Royal Geographic Society (RGS) and the Association for Geographic Information (AGI): Young Careers Network. With the RGS we support geography teaching at all levels, and the Chartered Geography accreditation from the RGS/AGI.

- Digimap, an initiative providing access to a range of datasets for the purposes of education and research.
- Royal School of Military Survey (RSMS): the development of an MSc aimed at geospatial intelligence leaders, and senior, pan-government education/training facilities.
- Government Geography Profession, and Digital, Data and Technology Profession: development of geospatial skills competency frameworks. The Geography profession has recently been formed as a sub-profession of Government Science and Engineering. It aims to support practitioners in the profession with opportunities for secondments, career pathways, and mentoring.

We would welcome the opportunity to lead/support the creation and management of a broader and cross sector 'academy', developing the geospatial capability of the future for the UK in collaboration with other geospatial and public sector bodies, accelerators, and private sector partners. Organisations such as the Royal Institute for Chartered Surveyors (RICS) or the Institute for Civil Engineers (ICE) are critical for sharing best practice and encouraging access to geospatial skills and qualifications.

There is a further opportunity to widen the current apprenticeship schemes to a broader multidisciplinary approach, where core geospatial skills are married to business, technology, innovation and creative capabilities. EPSRC are currently considering a bid for a Geospatial Systems Centre for Doctoral Training to admit twenty PhD students per year over five years, which would be a significant investment in such training. OS are preparing to support a secondment into the Welsh government to

Q4: How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

A 'geospatial data infrastructure' can mean two things – it can mean, as in Q10 – the infrastructure required to support the collection, management and supply of geospatial data – this would include, for example, the infrastructure necessary to support the geodetic reference framework. The second meaning is the part of a wider data infrastructure which relates to geospatial data, such as those set out by the United Nations Fundamental Data themes.

Within the government sphere, OS continues to hold to the principle of clear separation of duties in creating and managing particular data registers – 'one data, one place, one authority'. The Commission is well-positioned to ensure complete coverage of geospatial data assets, and the necessary standards for linking, interoperability and accessibility.

From our experience, there are datasets which would benefit from improvements to their quality or greater accessibility. To mobilise the value in these datasets, it is imperative that the Commission, and ultimately those who will use those datasets, take a system-wide view about interoperability and standardisation. Doing this will lead to a far greater value proposition, and supports Government's initiatives under the Industrial Strategy, including the introduction of the Centre for Digital Built Britain.

- Local authority datasets

  These datasets, including those relating to local plans, public rights of way, planning applications and traffic restriction orders, all suffer from being inconsistent in terms of quality, completeness, format and availability. Improved data would significantly reduce the manual effort required in obtaining and processing datasets at a national level. The solution is likely to be a mix of mandated standards and

financial incentives for local authorities. Government could consider a national planning applications service to help streamline and standardise datasets, as well as improving the service to citizens.

- Community Risk Registers

  These Registers contain a wealth of valuable information for resilience planning. In our experience of recent exercises, these are often locked in documents and not readily useable by national agencies – this represents a serious risk.

- Valuation Office Authority (VOA) datasets

  These datasets contain of a wealth of information about building type, age and construction material which would be of great value to a wide range of users across public and private functions. At present, access to VOA data for residential properties is restricted by legislative order. This may require further consideration.

Encouraging a national register of datasets collected in the private sector would be a welcome development. This task would be made considerably easier if all geospatial datasets were defined and published in a way that makes them easy to find and use, e.g. Data.gov.uk.

- Utility datasets

  A lack of consistent information about the location of gas, water, electricity and telecommunications networks is problematic. Time-consuming efforts to identify and locate assets hampers construction projects, and increases the risk of striking buried assets. Many European countries are addressing this problem by mandating the publication of utility asset data through regulation.

  Please see the following case studies in *Appendix one* providing information on OS' recent work to support data collaboration over subsurface assets:

  - Project Iceberg: subsurface data collaboration
  - A prototype for combined data at the North East Underground Infrastructure Hub

- A definitive rail network

  This is not available in the UK, and is hindering efforts to develop fully integrated multi-modal mobility services.

- Location occupancy/footfall data from mobile phones

  This is an emerging class of data with significant potential to assist a range of public and commercial activities. At present, this type of data is immature and fragmented across several providers.

Data infrastructure

Data assets are only one aspect of this wider data infrastructure. A data infrastructure has several core elements, including standards and technology, legislation and regulation, and the institutional arrangements required to enable the interoperable use of data.

The United Nations is developing an Integrated Geospatial Information Framework[1] which would be an appropriate place to start in assessing where beneficial investments should be made. The component parts are:

[1] *http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf*

- Governance and Institutions
- Legal and Policy
- Financial
- Data
- Innovation
- Standards
- Partnerships
- Capacity and Education
- Communication and Engagement

A review and gap analysis against this framework would provide a comprehensive approach to developing an infrastructure rather than solely focusing on data assets.

A note on implementation…

Data usability and value issues extend beyond 'accessibility' and 'quality' and are significantly affected by financial incentives and business models. Producers and custodians of datasets require clear financial incentives to maintain data to a required specification and quality, which are themselves highly dependent on use-case. An example of this is PAS 256, a standard for the collection, recording, maintaining and sharing of information and data related to underground assets, which to date has had limited impact, partly due to a lack of incentivisation to share data which is fit for purpose.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

We recognise that the addressing conversation is a complex one. Geoplace came about as a result of a previous government's decision as a way to improve the address quality for Great Britain. The National Address Gazetteer has been recognised as the solution of choice for the public sector, and we are proud to support its work in partnership with the Local Government Association.

The Geospatial Commission has already committed to explore opportunities to open the key identifiers of UPRN and USRN. This is a positive step, as expanded use of UPRNs will help ensure that the addressing infrastructure is widely used and valued. We recognise that a single address registry is an ambition, as the value of common addressing presents the largest opportunity for public sector efficiency, but it would be necessary to unpick the political decision taken in 2011.

Linking to UPRN

The driving global trend is towards address 'currency'. For example, shorter address data life cycles for temporary structures and the greater linking of government data to UPRN.

Asset registers, including new ones, should be linked so that other permanent features (lamp posts, etc.) have a UPRN derivative.

Future use cases

Changes to address data are a subset of the Internet of Things and fine geography requirements. Delivery points are a single feature in a building, others include: smart meters, fire exits, telecommunications repeater stations, accessible toilets which will require classification, and exploitation to support the realisation of benefits from emergent technologies. There is an increasing need for rich geometry and attribution to be accessible via addresses.

OS would benefit from open and consistent address data from a change intelligence perspective. Local Land and Property Gazetteer (LLPG) and National Address Gazetteer (NAG) data has great potential if maintained in a consistent way, and with more mandatory fields. The same is true for the National Street Gazetteer (NSG).

At a granular level, and using OS as an example, change intelligence can be derived from NAG and NSG if maintained effectively with mandatory fields which would lead to better data currency and resilience. OS is perfectly positioned to not only take change intelligence feeds to enhance the currency and completeness of its data, but to link 3rd party datasets – including National Rail, BT and Post Offices – to OS maps, bringing consistency and improving interoperability (ref: National Location Framework). This also would lead to a better product and an improved OS offer.

The quality of outputs could be improved by sharing data access across the sector and cross-referencing with overlapping datasets. In time, this could be maintained automatically with improvements achieved from customer and user feedback.

Our work to deliver OS' Public Task has highlighted requirements for vernacular names to be included in OS data, in support of emergency services. This could include collating information from sources such as Fintan (HM Coastguard), the Mountain Rescue vernacular name database, and crowd-sourced third party data, e.g. yourPlaceNames[2]. This would enhance our offer towards a potential Emergency Services Gazetteer.

Q6: How should the Commission be looking to develop the UK's capability in Earth Observation data, both technologically and to support an effective market?

For the context of this response, OS defines Earth observation (EO) as satellite-derived data and information that can be obtained from a variety of sensors. We recognise that there are wider definitions of Earth observation, including in-situ or airborne observations, however these are out of scope for our response.

OS has been encouraged by the rapid development of EO-related technologies in recent years, including the leading role played by British companies in stimulating development and innovation. We have recognised the potential for satellite-derived EO data to detect topographic change, and to provide input into land cover and land use datasets. These changes are removing some of the barriers to adoption of EO by OS[3] into its internal processes and workflows. We believe EO can deliver:

- Operational efficiencies[4]: e.g. change detection (change driven topographic review process, increases currency while reducing detection time).
- New data outputs: e.g. variable land use classification; temporal variance (land use/cover change) and change notification (monitoring).

However, barriers to adoption of EO data remain in the wider market. One of the most significant barriers is the cost associated with the storage, management, and usability of EO data. The operational logistics regarding access to data and making it ready to use has increased as a direct result of the greater volume of data now available from multiple sources.

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[2] *www.yourplacenames.com/vernacular/*

[3] *https://londoneconomics.co.uk/wp-content/uploads/2018/07/LE-IUK-Value-of-EO-to-UK-Government-FINAL-forWeb.pdf* (page 28)

[4] A practical example of this is OS's work with the with the Mohammed Bin Rashid Space Centre (MBRSC) in Dubai to automate the production of geospatial information *https://www.ordnancesurvey.co.uk/international/case-studies/dubai-auto-change-detection.html*

Technical barriers for use also exist for most potential users of EO. Data is often 'raw', as it is made available without the necessary processing operations (sometimes referred to as image restoration and rectification, intended to correct sensor- and platform-specific radiometric and geometric distortions of data) that are required to bring EO data to a usable level.

In isolation, EO data does not provide answers to many of the questions that potential uses are likely to be solving. Focus should be on turning EO into actionable (analytic ready) data by its integration with other data sources (such as land registration data, population statistics and topographic data such as DTM/DSM). We note the efforts being made by EuroGeographics, working with the European Economic Area, to facilitate the use of authoritative national reference data in the in-situ component of Copernicus.

"(Space Component) + (*in situ* Component) = Actionable Insights"

The Geospatial Commission could use its position at the centre of geospatial policy to address some of these issues, through working more closely with the technology lead on Earth observation (UK Space Agency) and the current centre of excellence (in Defra). A focus on user needs and potential applications of Earth observation, would help focus investment and coordination, cutting down on duplication and making more EO data useable at the point of access, referred to as Analytical Ready Data (ARD). This could include the provision of a national height model (DTM) to address geometric distortions would ensure consistency as well as alignment to in-situ (geospatial) data sets.

Similar approaches can be identified internationally. For example, Australia has been proactive in the promotion of their (Open) Data Cube technology, which is being used in a number of countries and regions (Digital Earth Africa). Implementation however could take many technological and commercial forms e.g. Google Earth Engine[5] and the GEOSS Portal[6], especially as the Data Cube concept is mainly focused on data curated over a long period of time, and at lower resolution.

It is important that the UK continues to benefit from the ESA's Sentinel data (Copernicus) and services, post the UK's exit from the EU. EO has an important role to play in supporting multiple Government Policy Departments[7], as well as the geospatial community more generally. In addition to working more closely with the UK Space Agency and Defra, the Commission could help provide support to non-departmental public bodies, such as OS, who are working with international forum (CEOS, GEO) through which the benefits of Copernicus data remaining free and open more generally can be articulated more effectively.

While Sentinel provides welcome data at a medium resolution, access to Very High Resolution (VHR) EO data is still prohibitively expensive for many potential users in the UK. Making this VHR data and other 'national coverage' geospatial datasets more readily available, or through developing UK systems that can deliver very high resolution EO data, would benefit many areas of society[8] including farmers, ecologists and the extractive industries. The current initiative by UK Space Agency to provide a national, VHR satellite imagery sample data set available to Government entities is a huge step in the right direction. We anticipate that the results of this trial will inform the thinking around the debate of the UK's national EO infrastructure offer.

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[5] *https://earthengine.google.com/*

[6] *https://www.earthobservations.org/index2.php*

[7] An example of which is the OS study for DEFRA on an Earth Observation Data Integration Pilot, using Earth observation data to introduce greater efficiencies and improved consistency in the updating of land parcel information on a national scale. *https://spaceforsmartergovernment.uk/case-study/eo-dip-validation-of-rural-payments/* (full report to be published)

[8] As shown through the Coastal Erosion and Accretion Study Report, for UKSA as part of the Space for Smarter Government Programme *https://spaceforsmartergovernment.uk/case-study/ukgeos-earth-observation-for-coastal-erosion-and-accretion-monitoring/*

Q7: Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The Commission is ideally positioned to invest and guide the development of a data infrastructure that is capable of making the most of emerging geospatial technologies to improve UK social and economic outcomes, using policies and investments targeted on high-quality, evidence-based approaches.

As with Earth observation, there is a risk that technologies are pursued for their own sake, rather than focusing on how they produce better outcomes for users.

OS has identified the following technologies as having significant potential for geospatial data to enable economic growth:

- Internet of Things
- Earth observation and sensing technologies from multiple platforms
- 5G and full fibre connectivity
- Connected and autonomous mobility, including vehicles and drones
- BIM
- AI, machine learning and automated decision-making
- Big data technologies (suitably extended to handle the unique properties of geospatial data)

Together, these technologies are empowering significant economic opportunities in the following markets:

- Intelligent mobility: Connected and autonomous transport, alongside electrification and vehicle sharing innovation, promises significant future social, environmental and economic benefits. OS is exploring this through its engagement in E-CAVE (Enabling Connected and Autonomous Vehicle Environments) and OmniCAV (testing Connected and Autonomous Vehicles) projects.
- Asset management: Geospatial frameworks can greatly enhance the value of asset data for whole-lifecycle and whole system optimisation rather than just e.g. construction or for individual networks. OS is exploring this through its engagement with the Centre for Digital Built Britain and the Digital Framework Task Group.
- Advanced connectivity: The deployment of full fibre and 5G technologies will be the focus of significant investment over the next decade; geospatial data will be vital in minimising the costs and risks and maximising the benefits of this investment. OS is exploring this through engagement with the DCMS and Bournemouth 5G project, and through participation in the 5G Innovation Network and urban and rural connected communities' projects. Please see *Appendix one*, *case study: OS innovation in Bournemouth to support 5G telecommunications infrastructure.*

  Additional policy benefits of advanced connectivity are referenced in the forthcoming White Paper, *Everything happens Somewhere* (November 2018).

- Smart Cities System infrastructure: Geospatial data will be central to applying system-of-systems projects for integrated management of Smart Cities. Please see *Appendix one*, case study: *Smart cities – the Manchester CityVerve project.*

In addition, the United Nations Group on Geospatial Information Management (GGIM) published a report on Future Trends in Geospatial Information Management in 2015. The report, produced by OS on behalf of UN

GGIM, recognises a number of broad trends in geospatial production and analysis which may be useful for the Commission.

All these new technologies will develop alongside AI and data trust capabilities. This increasingly networked data environment also exposes individuals and organisations to new questions of privacy, ethics, trust and security of data, particularly where multiple sources are conflated. Consideration of solutions to manage locational privacy and security is vital. Best practice is being created by the PETRAS (petrashub.org) research consortium.

Q8: How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The core value of geospatial approaches is that location (three dimensions) and time (fourth dimension) represent a powerful means of authenticating multiple types of information and enabling interoperability between datasets, systems and domains.

In generic terms, geospatial data needs to have the following attributes to be able to support these technologies:

- Analytic-ready

  Increasingly, geospatial data needs to be consumed by machines and algorithms, and to support real-time data flows for simulation and prediction. This requires a shift away from cartographic-oriented models and formats, to more data-centric representations and compatibility with mainstream information standards. This requirement was demonstrated by OS' participation in the CityVerve project, which relied heavily on analytic-ready data (see *Appendix one*, case study on the CityVerve project)

- Interoperable

  Connected systems and devices increasingly demand interoperability. This is not just a question of data formats; it extends to ontologies and compatible definitions of the world and its features. This requirement was demonstrated by OS' participation in the ESPRESSO project, which developed a blueprint for cross-functional Smart City services.[9]

- Federated

  The future of geospatial data is to enable real-time connection and compatibility with external data sources, including volunteered (user generated) geographic information. This requirement was demonstrated by OS' involvement in the OGC Future Cities Pilot project, which demonstrated real-time data flows.

- Compatible with multi-media visualisation and consumption
  Data needs to be capable of being consumed in multiple ways, including visual, and rendered in dynamic and immersive environments on a variety of media and devices. This requirement was demonstrated by OS' participation in the CityVerve project, which presented the project outputs in a virtual reality environment (see *Appendix one* case study).

Potential technological innovations

[9] *https://www.ordnancesurvey.co.uk/about/news/2016/os-committed-to-european-smart-city-standards.html*

- The rollout of next-generation connectivity

  4G and 5G radio (potentially served through both cellular and satellite infrastructure), fast Wi-Fi and full fibre backhaul will provide the crucial environment for a wide range of future industries and public services. For example, blue-light services collaboration could be enhanced through apps which offer insight exchange, real time data flows and common operating pictures. Key regulatory challenges are:
  - To ensure sufficient service provision to more remote and less lucrative areas
  - To support the update and sharing of data about key infrastructure assets, such as lamp posts, for efficient service deployment. OS has explored this as part of the DCMS Bournemouth project – see *Appendix one*, case study.

- The realisation of Connected and Autonomous Vehicles (CAVs)

  Geospatial data is a key component of intelligent mobility. CAVs, electric vehicles and new shared ownership models are likely to have a profound long-term effect on travel behaviour, and ultimately the geography of Britain, with reduced space requirements for vehicles in both residential and business areas. This innovation will require a host of regulatory and public sector interventions to ensure beneficial public good outcomes (for instance, relating to safety, accessibility, congestion and air quality) particularly in considering the impact of the interaction of multiple CAVs in dense environments.
  In 2017, OS was awarded funding for the E-CAVE project (Enabling Connected and Autonomous Vehicle Environments), as part of the Industrial Strategy Challenge Fund. The objective of the project was to design the neutral frameworks, data and resources for CAV data exchange. E-CAVE will enable real-time vehicle-to-vehicle and vehicle-to-infrastructure data sharing, using open standards and architecture. The project focuses on positioning and safety, underpinned by geospatial technologies and standards. OS is working closely with industrial and academic partners, and the government-funded CAV Test Beds to accelerate the UK's CAV testing capability and develop new business models which exploit the value of CAV data exchange.

- The development of a National Digital Twin

  A 'digital twin' is a realistic digital representation of something physical. In this context, it is a digital representation of assets, processes or systems in the built or natural environment. What distinguishes a digital twin from any other digital model is that a digital twin attempts to represent reality accurately, in contrast to some models that intentionally simplify it. Visualisation makes digital twins look real, but it is the quality of the data on which they are based and the code at the heart of the model that makes them realistic representations of reality. See *Appendix one*, *case study: The benefits of a digital twin approach* for more information.

  A National Digital Twin is the prime focus of the Digital Framework Task Group (DFTG), established as a result of the publication of the National Infrastructure Commission's *Data for the public good* report.[10] A National Digital Twin is intended to be a federated environment showing multiple representations of the UK's economic, social and ecological infrastructure; a centrepiece of Britain's digital capability, enabling improved scenario planning, operational monitoring and reporting in a system-of-systems approach.

  The right application of high-quality integrated geospatial data offers the UK an opportunity to better plan and maintain energy and utility infrastructure, essential in the delivery of future technologies. An upcoming OS whitepaper *Everything happens somewhere* (Nov 2018) addresses the potential risks and opportunities for geospatial data to enhance UK energy infrastructure.

[10] *www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf*

Theme 2: Enhancing the UK's geospatial assets

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

UK geospatial data infrastructure

As noted above a 'geospatial data infrastructure' can mean two things – it can mean, as in Q10 – the infrastructure required to support the collection, management and supply of geospatial data – this would include, for example, the infrastructure necessary to support the geodetic reference framework. The second meaning is the part of a wider data infrastructure which relates to geospatial data. Data assets are one aspect of this wider data infrastructure. 'Data infrastructure' has also been defined in several ways, but the majority of definitions identify the core elements as being the data assets, standards and technology, legislation and regulation, and institutional arrangements required to enable the interoperable use of data.

In accordance with our Public Task as the National Mapping Agency for Great Britain, OS must continue to maintain and enhance Great Britain's geospatial data assets. To do this, we must continue to invest in and enhance our infrastructure. The data infrastructure we require includes the data assets, technology and development of standards and data sharing arrangements, within an enabling national regulatory system. All aspects of the infrastructure should be considered and not just the data assets.

As part of the UK Location Programme driven by *Place Matters: The Location Strategy for the UK* (2008), a considerable amount of effort was put in between 2008-2012 to the creation of the UK Location Information Infrastructure (UKLII). There are lessons to be learned from this period: a clear central mandate, investment and coordination across the Devolved Administrations and local government are required if a UK strategy is to succeed. The initial implementation of the INSPIRE Directive provided much of the impetus for the UKLII.

Physical and system infrastructure

OS must continuously improve its physical and system infrastructure to deliver against our Public Task. This includes investment in OS Net – see *Appendix one*, case study: *OS Net – a fundamental geospatial asset* for more information.

In a data-rich world, OS will continue to increase accuracy, data resolution, securing continuity of supply and frequency of updates, as these are key to good quality services, as well as maintaining trust and confidence in the data. OS will continue to support the specific needs of Government through our agreed Mapping Agreements with Government and Devolved Administrations. OS would welcome the opportunity to undertake product co-development with Government, ensuring that delivery takes into account wider or alternative use cases, in order to maximise the benefits of the investment.

The United Nations is developing an Integrated Geospatial Information Framework[11] which would be an appropriate place to start in assessing where beneficial investments should be made.

[11] *http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf*

The component parts are:

- Governance and Institutions
- Legal and Policy
- Financial
- Data
- Innovation
- Standards
- Partnerships
- Capacity and Education
- Communication and Engagement

A review and gap analysis against this Framework would provide a comprehensive approach to developing an infrastructure rather than solely focusing on data assets.

Investment in data infrastructure

OS is continuing to invest in data infrastructure. We are investing in making our content accessible, discoverable, useable and consistent in terms of being up-to-date, using a consistent language, and enabling customers to easily associate their data to multiple views/content. See *Appendix one*, *case study: responding to customer requirements with the Open Zoomstack trial*

The recently announced 'unlock' projects, to be delivered in partnership with the Geo6, are a step toward improving outcomes.

Further opportunities for the Geo6:

- Building on recent successes, it may be that Joint User Groups are considered across the Geo6, with a single point of contact within each member organisation
- Taking a collaborative approach to research and innovation to unlock opportunities from a potential single geospatial asset, but which also accepts the limitations on OS arising from open data arrangements and commerciality
- Streamlining data exchange/delivery mechanisms, perhaps a single data/API portal, in order to increase efficiency

Commercial models

As a Government Company, OS is exploring new models to make its data products more commercially fit for purpose. We are developing enhancements around sensed data, systems of reference, and geo-production, and are looking to take advantage of the opportunities presented by AI and the use of multiple sensors. Greater automation in data collection would lead to lower cost and more up-to-date data. We will continue to develop closer relationship with our customers, and harness the opportunities offered by their feedback.

OS is also investing in Geovation, the hub for property and land innovation, supporting business start-ups to grow and succeed. See *Appendix one*, *case study: Geovation*

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should we prioritise the development of to support the emerging requirements for geospatial data?

All positioning and mapping must take place on a mathematically simplified model of the surface of the Earth - from positioning within watches, to surveys for civil engineering projects and land administration. A robustly defined and accessible national geodetic framework is fundamental to link together all types of spatially referenced data. There is a fundamental role for government to maintain and develop the benefits and outcomes from this framework.

The 2015 United Nations Resolution entitled *A global geodetic reference frame for sustainable development* laid down the purposes and principles for the creation of an underpinning geospatial infrastructure. This encouraged Member States to enhance global cooperation in providing technical assistance, urged the implementation of open sharing of geodetic data, invited commitment to improve and maintain appropriate national geodetic infrastructure and multilateral cooperation.

There are a number of key elements of this infrastructure spread throughout Government, for example: British Geological Survey (BGS), OS, the Natural Environment Research Council and the National Oceanography Centre.

To meet emerging requirements, some areas for development are:

- To ensure that we have well-defined frameworks and systems that enable the integration of the outside, with the internal building view, alongside the assets that sit underground, linking together multiple positioning techniques.
- To better utilise the existing underpinning geospatial infrastructure more, for example the GNSS network (OS Net) to help understand the impact of interference on GPS users, especially in the field of critical national infrastructure (as described in the Government Office for Science's *Satellite-derived Time and Position: A Study of Critical Dependencies* review[12]). Please see the *Appendix one* case study: *OS Net*, for more information.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a role in both supply and demand for geospatial information across the UK economy. OS operates on a partner model with over 400 commercial organisations who create products, applications, and services using our data, responding to user requirements or adding analytic services on top of what we make available in agile, responsive way.

We also recognise the value of a strong voice for geospatial industries from the Association for Geographic Information (AGI) to help raise and influence shared issues across the 'geo' sector.

[12]*https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/676675/satellite-derived-time-and-position-blackett-review.pdf*

In our experience, most private sector partners, regardless of market sector, are reliant on a consistent, trusted reference framework for geospatial applications. The public sector, without commercial bias, is trusted to provide an authoritative, 'single version of the truth'. That enables critical national infrastructure and services and the inter-operation of data and benefits to be derived.

However, while many private sector partners excel at innovation within a framework, the utilities are an example where no standard or framework for geospatial data exists. The issues of sharing data across the energy and utility infrastructures has emerges as a perennial problem for both street works and infrastructure planning. The Government can play a role in defining the expectations and boundaries for commercial activity, and even act as a trusted broker (see *Appendix one* case studies relating to Northumbrian Water and Project Iceberg) while leaving room for innovation and investment by the private sector.

One example of excellent collaboration is the ICE's Project 13, where the engineering firms are tackling challenges around digital assets for major infrastructure and construction projects to anticipate and drive best practice for major projects. Industry, in this instance, is aligning itself to government policy objectives, as government acts as a major commissioning/procurement body.

There may also be a role for private sector to provide better access to third-party data which could enrich the UK's national geospatial assets. The exponential growth in data sources and sensors over the last ten years, could form a critical flow of real time geospatial information into a digital twin. Government should still hold a reference set for this data and may need to tackle issues of privacy and veracity as the data is shared, but third-party data should be complementary, not competing with the reference data, as it serves a very different purpose.

Q12: Do you face challenges when working with geospatial data from across the public sector? If so, what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Through the delivery of the Public Sector Mapping Agreement, OS works daily with more than 5000 public sector users of its geospatial information. That experience of directly working with users, as well as our research into the next generation of public sector requirements, means that the OS has a unique insight into the challenges that emerge from trying to overlap and interoperate with public sector data.

Some of the more significant challenges in working with data from across the public sector include:

- Uncertainty over what the commercial arrangements are for a dataset
- Legal and regulatory barriers
- Cultural barriers e.g. the concerns of others about sharing data
- Knowing what datasets are available (and their currency and quality)
- An array of individual licensing agreements including data that is badged as open data but has restrictions on use
- Lack of interoperability between datasets
- No feedback mechanism on issues found with the data
- No guarantee that feedback will be acted upon when a mechanism is identified

- Different business drivers behind every organisation. For some, the data is what they are there to produce, for others it is a by-product. This impacts on the importance that they place on their data and how much effort they are prepared to spend on fixing and maintaining it

Integration of third-party data – a Digital Land Review 'unlock'

OS has found it challenging to access publicly-held geospatial datasets to support the development of new and existing data capture requirements. To support this, OS has created a data catalogue of third-party datasets. Poor quality and incomplete data mean that third party data are not always viable alternatives to in-house production methods such as those used by OS. For example, local authorities collect and maintain highways data in numerous different systems and formats. The ability to incorporate geospatial datasets could be improved by introducing royalty agreements into OS products and increasing collaboration between all suppliers of geospatial data.
Potential remedies are:

- Harmonisation of standards and licence information
  We know from INSPIRE that standards imposed from the top can be clunky. Data must be accessible and useable. Government could intervene when there is no motivation to standardise, or resource to do so. It would be good to see an agreement/alignment on standards and licence information to make it explicit, correct, and preferably machine-readable to facilitate sharing and exploitation. The official British Standards Institution committee for geographic information (known as BSI IST/36) already has this as part of its mission – perhaps this could be a useful body to help drive this forward.[13]

- Focus on interoperability
  Government could usefully intervene to make data interoperable, and linked to UPRN. A good starting point would be to streamline the local authority and national planning system through digitisation. Working with these data outputs is time-consuming and costly. A national planning portal could revolutionise the planning process and allow many other organisations to place their data in the solution. It should be possible to see existing data, the proposed planning area, the utilities, land ownership etc. all in one place. New Burdens funding may be required to progress this.

Q13: How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

A relationship with business

The Geospatial Commission could usefully support public-private partnerships with both large corporations and small and medium enterprises. Considerable value could be gained from working with private sector companies to share geospatial change intelligence data. The tracking of land use change could also support housing development and help local communities to thrive.

Focus on customer needs and requirements

The Commission could usefully give data producers the space to work with, and closer to, their customers. OS would welcome the opportunity to share its work on user requirements with the Commission. Actions which help the sector to collaborate and share best practice would be welcome.

[13] *https://www.agi.org.uk/agi-groups/standards-committee*

Guide geospatial expertise into Whitehall

The Commission could look to fund geospatial subject matter experts (including those who work for data asset owners) into key Government Policy Departments. This could help improve awareness of the value of geospatial data, and provide a bridge between those Departments and the Geo6, ONS and other data providers.

Q14: Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Please refer to our response to Q4 setting out our views on priority themes and datasets.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The Geospatial Commission has an opportunity to write a policy-based, outcomes-focused National Geospatial Strategy, which is both clear about what success looks like for the UK, and well joined up with current Government strategies, including: Industrial Strategy, National Data Strategy and Transformation Strategy. The Commission should commit to consultation on the draft Strategy to allow for the identification of gaps or points of diversion with existing strategies. It would be a missed opportunity if the strategy were merely a series of discrete projects.

Strategic alignment across the UK will be a challenging task; some policy areas which use geospatial data, such as environmental policy, are matters within the jurisdiction of Devolved Administrations. That said, a single UK strategy can recognise that areas of the UK have distinct areas of specialism. For example, Scotland is particularly strong in coastal and rural geospatial expertise – see *Appendix one*, *case study: OS data being used to predict coastal change in Scotland*. A successful UK-wide strategy should draw on these areas of strength and encourage the sharing of best practice.

Experience from the UK Location Strategy would indicate that a common acceptance of the need for, and benefit of, a common data infrastructure is required in order to bring together the parts of the UK. In 2008 it was the common need to implement the INSPIRE legislation which drew together the Devolved Administrations. This requirement still exists and will continue to do so post-Brexit. Infrastructure development is an area which will span each individual strategy, although its implementation, and application may be a devolved issue. An appropriate framework to support and facilitate coordination across the UK would be the national approach to implementing the UN's Sustainable Development Goals. There are common data requirements across the UK not just for the measuring and monitoring of these goals, but also the programmes of actions required to achieve them. A clear line of sight can be shown between global strategy, national direction and local action.

Q16: How can we best ensure effective local authority co-ordination and sharing of best practise, using location data to better deliver public services?

We would suggest that local authorities are already coordinating activity and sharing best practice.

An effective model for sharing and best practice needs to deliver benefits for all those contributing to it; 'one way' relationships will not be effective in times of reducing budgets and higher workloads. In addition, the

right environment must be created for this to take place, an environment that provides support, sharing capabilities, recognition of success and incentives for continual improvement.

One approach to achieving this can be to use effective existing models. For example, having a centralised, detached organisation responsible for coordinating information-sharing to deliver a particular function. In 2010, following a consultation, the Department for Communities and Local Government recommended that a joint venture be set up between OS and the Local Government Association to create a new single source of address data. Today GeoPlace maintains the NAG that supports the needs of both the public sector and a wider commercial market and ensures effective local authority coordination and sharing of best practise. A consistent 'AddressBase', free to all public services, was seen as vital to deliver essential services to UK citizens, right through from ensuring benefit payments are going to the right place through to arranging school buses effectively.

In addition, working groups made up of those with common interests/challenges have also proven effective. For example, we have instigated a new working group called Government Address Interest Network which brings together cross-government teams to learn from each other's' experience of implementing authoritative address data. This information-sharing has delivered business efficiency outcomes in departments like HMRC and in the Health sector.

A 'Centre for Geospatial Excellence' might be part of the answer to effective local authority coordination, responsible for building capacity and best practice across local authorities and government Departments/delivery agencies. The Commission should look at the Scottish Spatial Hub[14] and the Scottish Local Authority Improvement Service as positive examples of improving outcomes at the local authority level.

Incentivising and recognising hard work and innovation through awards, and bringing together regional groups so users can support each other, help to break down silos and encourage collaborative working.

Combining datasets

Data that provides information on the built environment such as Valuation Office Agency, NAG, Building Control and the NSG play a crucial role in creating a digital view of the world. This information could be opened up to the geospatial community as a combined suite of material. A combined view of these datasets could, for example, assist utility companies to plan and maintain their geospatial information and assets.

OS spends time and effort 'mining' numerous data sources to fill intelligence gaps related to the NAG and NSG. Effective shared software tools would help local authorities, for example, to capture and maintain change more effectively and in a controlled environment. If this is done against a live OS data view, inconsistencies could be highlighted and corrected.

[14] *https://www.spatialhub.scot/*

Theme 3: Driving investment and productivity in geospatial applications

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- property and land
- infrastructure and construction
- mobility
- natural resources
- sales and marketing

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value (we would particularly welcome responses from industry and other bodies engaged in these sectors)?

OS agrees with these high-value categories.

For more information about how OS is supporting the property and land sector, please see *Appendix one*, *case study: OS data supporting the property and land sector*.

Q18: Are there any other areas that we should look at as a priority?

Other areas of focus could include:

- defence and security
- environment and agriculture
- national resilience and predicting/reducing the impact of natural disasters
- sustainable energy, supporting the Government's clean growth strategies, and a fundamental enabler of infrastructure and mobility categories
- tourism
- Public Health, including supporting Government's priority to improve mental health by promoting access to, and information about access to greenspaces and greenways
- financial services – *please see case study: OS data supporting financial services markets*

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

Please refer to our responses to questions seven and eight regarding innovations which are likely to require geospatial data to roll out.

In addition to the regulatory challenges relating to privacy, drones and CAVs as set out in the Call for Evidence, the Commission may also wish to consider issues arising from:

- grid-stability and cyber-security
- consumer protection
- competition and intellectual property
- outcomes from the June 2018 Centre for Data Ethics and Innovation consultation[15]
- the roll out of BIM in both the public and private sectors
- the need to license historical data and imagery

Q20: How best can we make the UK's presence in the international geospatial world more visible?

UK Geospatial agencies such as UKHO, OS, Met Office and BGS have excellent reputations overseas, but this recognition and desire by other nations to learn from UK geospatial organisations is under-recognised by UK Government. In OS' case, this global reputation is in part derived from: the past contribution made by OS to the mapping of many nations; our thought leadership contribution to international bodies and debate; delivering success and profit to the UK; and our innovation in data, services and national geospatial enablement.

National geospatial information capabilities vary across the world, from non-maintained 1970s paper (or scanned) maps, to nations that embrace geospatial within government digital policies and strategies. Equally varied in delivery capabilities are land tenure and the poorly-defined concept of 'Smart' and how it is enabled by geospatial data. OS and the Geo6 have a clear part to play in helping other nations through long term commercial, and UK Government Overseas Development Agency (ODA)-funded, partnerships.

Departments and businesses that embrace geospatial information in the UK are more likely to do so overseas. By being 'an exemplar' in the use of geospatial to improve government effectiveness and efficiency, business growth and consumer lives, the UK can build on its current global position, particularly by utilising Government's overseas agendas.

Competition should be recognised:

- USA leads geospatial industries, and invariably partnerships will be essential with these global players. The UK is strong but will need to fight to retain its position.
- Other nations, such as Korea, Canada, and China, and global businesses have major international aspirations in geospatial information and land tenure, often including national agencies. Many nations promote geospatial industries overseas ambitions through state funded ODA (e.g. Japan and Korea). This may give them an economic advantage.
- In some places Open Street Map, enabled by large corporations, is standing in for national mapping.

[15] *https://www.gov.uk/government/consultations/consultation-on-the-centre-for-data-ethics-and-innovation/centre-for-data-ethics-and-innovation-consultation*

Understand and promote UK geospatial capabilities overseas

The UK aspires to be a leading digital nation and is highly regarded for its efforts to make data accessible for social, economic and environmental benefit. Geospatial infrastructure, data and services are a fundamental component of a national information infrastructure, and are the foundation to enabling location to be a central means to understand, analyse, make evidence-based decisions, deliver programmes, projects and services, and measure the achievement of policy goals.

For UK geospatial, location services and data analytics companies to succeed internationally, a UK Geospatial strategy should stress globally accepted underpinning frameworks, such as standards.

Innovation and education

The Science and Innovation Network, Innovate UK and others play a major role in the UK, but also internationally – from co-funded programmes to a growing network of DCMS technology hubs. Geospatial programmes do not overtly feature, but could. Bilateral international geospatial Research and Development programmes would help the UK's presence internationally.

Other nations (e.g. Singapore, Western Australia) have created geospatial incubators to help start-ups and small businesses; consideration should be given to leading, promoting and supporting a network of such incubators as a means of enabling UK start-ups to link globally.

Nottingham University has campuses in China and Malaysia offering geospatial education, but the biggest University provider of geospatial education globally appears to be ITC in the Netherlands.[16] Many geospatial leaders globally have had an element of education in the UK, Europe or USA, and often reference it favourably. Promoting greater access to UK geospatial courses may help build these long-term relationships.

Government overseas (trade) strategies

Consideration of geospatial industry at all levels within the Department for International Trade (DIT), and its global promotion, is a natural step. This needs to be consistent with efforts on behalf of the UK digital industries internationally.

Promotion of the UK's data capabilities within trade priorities will therefore benefit the UK's geospatial agencies and industry. This can manifest itself through:

- DIT's efforts in particular, through Department, National and regional strategies such as the FCOs Gulf Strategy and DfID's *Digital Strategy 2018-2020: Doing Development in a Digital World*
- senior trade missions and briefing inward visits to UK
- government measures focussed on policy outcomes enabled by geospatial data, rather than data provision alone

Recognising a select number of key sectors and focussing on incorporating geospatial information into their international trade approaches would be logical. Those sectors might include: infrastructure, telecommunications, extractives, agriculture, defence/security/resilience, and transport.

Official Development Assistance

UK has contributed significantly to global mapping coverage since the Second World War, largely through the government funded programmes of the Directorate of Overseas Survey, that merged into OS in 1984.

[16] *www.itc.nl/*

Sadly, many nations national geospatial coverage dates back to this era. In March, Ghana's vice president stated that it was not acceptable that the Ghanaian national basemap had not been revised since 1974 and subsequently launched a procurement process for an updated national basemap. OS played an important role in this decision by Ghana.

UK ODA objectives include:

- strengthening global peace, security and governance
- strengthening resilience and response to crisis
- promoting global prosperity
- tackling extreme poverty and helping the world's most vulnerable
- delivering value for money

All of these benefit from geospatial information, including land tenure and capabilities, just as they do in the UK. However, ODA departments rarely consider geospatial programmes as an investment in their own right. This needs to be urgently addressed.

The United Nations Integrated Geospatial Information Framework, with its significant OS strategic and editorial involvement, is being utilised internationally, particularly in developing nations. Recognising and supporting this framework in relevant UK international activities and strategies would help its adoption and also assist UK ODA considerations.

In the Department for International Development's *Digital Strategy 2018-2020: Doing Development in a Digital World*, Rt Hon Penny Mordaunt MP, Secretary of State for International Development, states: "We will work openly and collaboratively with others who share our digital vision; for a world where digital technology will be accessible to all, and where no one will be left behind."[17] Digital technology requires data, and in particular geospatial data. Yet most nations that the UK Government supports through ODA have little trusted and accessible geospatial data, nor effective institutions to create and maintain it.

It is not sufficient to collect data project by project. The UK should work in partnership with developing nations to build sustainable national government data institutions such as statistics and national geospatial agencies as a matter of priority.

Equally, open data principles should apply in ODA project delivery, and often does. Geospatial data collected as an element of project delivery has a far wider remit than for that single project, and its management and release should be sought in such projects, adding significantly to the value of UK investment.

Ordnance Survey supporting UK objectives overseas

OS aspires to be recognised internationally as the world's most trusted and inspiring geospatial partner. OS works with industry partners to deliver international commercial offerings and projects.

Achieving OS' international engagement goals manifests itself in a number of ways including:

- Support for United Nations activity to meet the UN *Transforming our World: 2030 Agenda for Sustainable Development*.[18] There is a clear requirement for geospatial thinking and data in the achievement of all associated Sustainable Development Goals. This also applies to agreements such as the Sendai

[17] *https://www.gov.uk/government/publications/dfid-digital-strategy-2018-to-2020-doing-development-in-a-digital-world*

[18] *https://sustainabledevelopment.un.org/post2015/transformingourworld/publication*

Framework for Disaster Risk Reduction 2015–2030, the United Nations Framework Convention on Climate Change (Paris Agreement) and on the United Nations Ocean Conference: Call for Action. The UK is already active at this strategic global level through the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM): at a national level, directing activity and monitoring progress through ONS and relevant Government Policy Departments and Devolved Administrations; and at a local level, taking action in both the public and private sectors.

- Support for the Open Geospatial Consortium, influencing and bringing learning back into OS in equal measure.
- A current secondment to the Group on Earth Observation (see case study in reference to Q.6) related to work on EO and disasters.
- Providing senior subject matter expertise into governments globally, some of which may lead to downstream opportunities for OS and other UK companies
- Hosting the Cambridge Conference, the quadrennial meeting of global national geospatial agency leaders that has been running since 1928. In 2020 this will be run back-to-back with the UK hosted United Nations High Level Forum on Global Geospatial Information Management, the first such event in Europe

A clear line of sight can be shown between global strategy, national direction and local action which could be an exemplar internationally.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There is no direct comparison of our geospatial ecosystem with other countries.

The legal, regulatory, policy, and institutional context varies, along with the social, economic and environmental challenges, the geography of the country and the maturity of the geospatial industry. However, certain aspects can be explored in other countries to identify potential good practice which could be tested in our context.

Examples of overseas points of comparison include:

Pathway	Nations which could be considered for comparison	Learning point from practice modelled overseas
Governance and institutions	Abu Dhabi	ADSIC approach to facilitating an SDI and a geospatial community.
	Sweden; Lithuania	Holistic land administration and land governance; State Enterprise Center of Registers (one agency responsible for several key registers).
	USA	USA is considered strong in certain areas, its Federal Geospatial Data Committee and its potential Geospatial Data Act amongst them.

Pathway	Nations which could be considered for comparison	Learning point from practice modelled overseas
	Australia	Governance Framework for the Digital Built Environment *https://docs.wixstatic.com/ugd/800d93_d9423643750744d8aac5347d7c6004b6.pdf*
	Netherlands	Netherlands has created an oversight body for their geospatial infrastructure called Geonovum. See *https://www.geonovum.nl/*
Policy, strategy and legal	Oman	Trying to introduce and impose geo data/survey/map policy.
	Estonia	e-legislation.
	South Korea	Successful nationwide planning and roll-out of 3G network. UK could learn from this for its fibre/5G roll-out programme.
	United Nations	Integrated Geospatial Information Framework and Future Trends Documents.
	Australia	Geosciences Australia. Long term contracts to ensure government and industry invest in new capabilities with assurance of supply.
Financial	Singapore	Central funding for Virtual Singapore initiative and platform. Significant capital investment (The project was initiated at a cost of $73 million for the development of the platform as well as research into latest technologies and advanced tools over a period of five years).
	Netherlands	Self-financing: Government compensation for opening up geospatial data.
	Denmark	Investment in geospatial information predicated on the impact (savings) across government.
	Australia	Australian (MOD) GEOINT Organisation audit of all projects to determine future needs for GI and the removal of barriers to use. Includes 'data' sign off at gateways to ensure data aspects have been considered.
Data	Ireland	Integration of statistics and geospatial; data for national decision-making.
	Singapore	Virtual Singapore initiative and platform, 3D virtual model/digital twin of Singapore.
	Netherlands	Integrated approach to national mapping and built environment data, including high quality 3D city data models.
	Australia	Acceptance that time (4D) is an essential component of geodata as governments adopt digital twin approaches.

Pathway	Nations which could be considered for comparison	Learning point from practice modelled overseas
		Authorised, federated, fully interoperable, 3D datasets enabling users to model the Natural and Built Environment across Australia and New Zealand *https://www.vanzi.com.au/* NSW: Data recognised as an asset under state infrastructure strategy.
	Mexico	Mexico has a merged geospatial and statistics organisation.
	Israel	Tel Aviv approach to smart city based upon improving services to citizens.
Services	Dubai	Dubai has included spatial data as critical data and made policy that it be included on their data registers (just like other data e.g. statistical) within the Dubai Data Establishment.
	Netherlands	Kadaster services.
	Singapore	Services built on the Virtual Singapore platform to support experimentation, virtual test-bedding, planning and decision-making.
Innovation	Dubai	Dubai recognises the benefits of integrating geo data/tech with other areas to make superior services e.g. linking payment + ID + location together to monitor movement of people and funds.
	Taiwan	GeoSMS and Resilience services.
	Sweden	Blockchain, 3D, GIS/BIM.
	USA	Machine learning and AI research; data science and analytics; tech innovation (Silicon Valley, etc). Investing in tech businesses.
	Canada	Urban innovation (Sidewalk Labs is designing a district in Toronto's Eastern Waterfront to tackle the challenges of urban growth).
	China	Geospatial Industry 'parks' within tech city.
	Singapore, Western Australia	Geospatial business incubators.
Standards	Netherlands	Geonovum Coordinated management of a national set of geospatial standards.
	Norway, Sweden	Joining intelligent transport and geospatial standards.
	Germany	AAA model and roll out of 3D in a federal system.
	European Commission	INSPIRE standards are key to interoperability across Europe.

Pathway	Nations which could be considered for comparison	Learning point from practice modelled overseas
Partnerships	US	Blanket and quilt approach to national map; partnership model of US census.
	Netherlands	Kadaster and its partnership with private sector.
Capacity and education	USA	Geospatial skills certification programme.
	Australia and Netherlands	International Internships/fellowships into geospatial agencies paid by ODA budgets.
Communication and engagement	USA	USA: #1 in the GeoBuiz report for User Adoption Level.
	Singapore	Singapore: Govt/Gov Tech working with key Singapore agencies as both data providers and data consumers.

Appendix one: Case studies

Reference to Q.4

Case study: Project Iceberg: subsurface data collaboration

Project Iceberg is a collaborative project between OS, British Geological Survey and Future Cities Catapult to explore how to better capture, collect and share data about underground assets and geological conditions.

Currently there's a lack of information about the features beneath our towns and cities; there's incomplete data; and the approach to managing subsurface space is isolated and uncoordinated.

The aim of Project Iceberg is to demonstrate the value of interoperable data about the subsurface, including buried assets; to find a way of sharing all this information among a wide range of relevant organisations including utility and energy companies, the transport sector, street works planners and building developers, as well as the public sector.

Project Iceberg has found that there is a need to combine above-ground (e.g. existing city data systems) and below-ground information into one national single data model/data exchange framework which would allow the industry to share business developments and innovation activities. This is not a single map of the subsurface but a consistent framework into which data is supplied, assured, stored, accessed and analysed by a multitude of users in the short term, whilst appropriately safeguarding privacy and security.

These themes have now been picked up by the National Infrastructure Commission, in their report *Data for the Public Good*. It is hoped that by combining surface and sub-surface city data, the potential of new technologies can be realised. For instance, we would see augmented reality being used before any dig to safely identify the location of existing pipes.

For more information see: *os.uk/projecticeberg*

Case study: A prototype for combined data at the North East Underground Infrastructure Hub

Water, gas, electricity and telecommunications utility companies and local authorities have worked with OS on a 'sprint' as part of the 2018 Northumbrian Water Innovation Festival to develop a working prototype of what would be the region's first digital map of buried utility assets. *The Big Challenge, Going deeper underground - Can we build an underground map of the UK?* explored:

- the possibility of sharing infrastructure data held by the agencies involved
- the practical considerations of integrating underground data
- the overall business benefits around integrated data

The basic challenge was to gather insight into what pipes and cables there are in a section of ground before a hole is dug or a visit undertaken to a site.

A prototype model was built by OS' Consultancy and Technical Services team, with a view to exploring future pilot opportunities.

For more information see: *https://innovationfestival.org/ossprint*

Reference to Q.6

Case study: OS secondment to Group on Earth Observation (GEO)

GEO is a partnership of governments and organizations (*www.earthobservations.org/geo_community.php*) whose vision is for "a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations." GEO membership includes 105 Member governments (of which the UK is one) and 127 Participating Organizations comprised of international bodies with a mandate in, and/or use of Earth observations.

GEO is operating in alignment with three of the United Nations agreed agendas, the 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. Each of these have different requirements for Earth observations, from monitoring to implementation and understanding. Having strong, coherent engagement with national governments, and the stakeholder community enables Governments to mobilise and commit to adequate levels of resources. This is underpinned through strong advocacy for broad, open data policies and practices. Together, the GEO community is creating a Global Earth Observation System of Systems (GEOSS) that will link Earth observation resources world-wide across multiple Societal Benefit Areas - Biodiversity and Ecosystem Sustainability; Disaster Resilience; Energy and Mineral Resources Management; Food Security; Infrastructure & Transportation Management; Public Health Surveillance; Sustainable Urban Development; and Water Resources Management - and make those resources available for informed decision-making.

OS sits on the UK GEO-CEOS Office Policy Delivery Group and helps to coordinates EO related activities through this group (chaired by Defra and UKSA) and has committed to fund a resource into the GEO Disaster Risk Reduction programme. This will form part of the UK contribution to GEO, but is in addition to the core budget contributions to the running of GEO (see blog post from the Defra Deputy Chief Scientific Advisor Iain Williams, and currently represents the UK on the GEO Executive Committee: *www.earthobservations.org/geo_blog_obs.php?id=273*).

The secondment seeks to supports the GEO Disaster Resilience work programme (*www.earthobservations.org/area.php?a=dr*) by increasing coordination of EO to forecast and prepare for disasters, to mitigate damage and to better manage and recover from disasters. EO contributes to disaster mapping and better mitigation and response, working within the Sendai Framework on Disaster Risk Reduction (*www.unisdr.org/we/coordinate/sendai-framework*). There is a need to align the Sendai Framework targets with the Paris Agreement and the SDGs, and thus there is a close alignment with the activity that OS is engaged with through the UN-GGIM.

Reference to Q.7

Case study: OS innovation in Bournemouth to support 5G telecommunications infrastructure

Geospatial data on the natural and built environments needs to be married with integrated meteorological, geological, ecological, social and economic data to enable planners to predict the optimal location of both full fibre broadband and potentially 5G infrastructure. By linking location with network, planners will be able to identify specific areas that are likely to require additional investment due to their remoteness or any land restrictions. Businesses and communities will be able to benefit from reliable coverage if telecommunications companies can anticipate and relocate networks to avoid natural or man-made obstructions, from tree foliage to buildings.

A recent project in Bournemouth sought to address this by employing an integrated digital twin approach. OS helped plan the implementation of 5G across Bournemouth by integrating over 30 local datasets, including Met Office weather data and OS augmented 3D maps accurate to within 1-2 centimetres, to create a richly detailed, interactive digital twin of the city. This work enabled planners to identify how local features, from lamp posts to hanging baskets, could interfere with 5G signal quality in every area, and allowed them to model the effect of wind and clouds on network coverage at different altitudes.

The project showed the potential for reducing the costs of 5G rollout by identifying the optimal locations for each antenna, and therefore delivering maximum benefit to the local community. The use of geospatial data in this way was able achieve a 40% reduction in the planned number of antennae in achieving total coverage across Bournemouth. Such efficiency would lay the foundation to make investment more attractive for private telecommunications companies, could save time and reduce risks.

If the Bournemouth project could be scaled up to a nationwide level, not only could planners predict the optimal location of antennae to avoid signal interference from nearby buildings, they could also identify the perfect location to increase digital productivity or boost business growth in a disadvantaged area. Unifying infrastructure data into a multi-layered ‘master map’ would allow companies to collaborate across sectors on new projects, from rail lines to 5G grids, ensuring that each new network aids the success of all the others, without an intolerable increase in risk. It would enable town planners to make whole system decisions rather than just optimising each network for individual performance.

For more information see: *www.ordnancesurvey.co.uk/5g*

Reference to Q.8

Case study: Smart Cities – the Manchester CityVerve project

OS was part of a public–private consortium awarded £10m competition by DCMS to run an Internet of Things Demonstrator project. The CityVerve project looked at how location data can be modelled, in order to give us

a better understanding of how a geospatial approach can enrich services and lives in smart communities of the future.

Smart City programmes all require accurate and interoperable mapping and location data to enable robust analysis. Without mapping, geography and Geographic Information Systems, it would be impossible to create a Smart City environment powered by the Internet of Things.

OS' role was to provide the geospatial framework upon which the project activity was based. Our location expertise and geospatial infrastructure supported use cases such as way-finding, road safety, and building asset management. In addition, we provided accurate location and attribution data for street-side assets, such as lighting, signs, and bus stops.

By sharing the lessons learned in developing people, processes and technology, OS is helping Smart City projects to use geospatial data and services to underpin a wide range of policy and business processes. Outcomes from this project may be applied to other areas of the UK and around the globe.

For more information see: *cityverve.org.uk/*

Case study: The benefits of a digital twin approach

A 'digital twin' is a realistic digital representation of all natural and built assets. An integrated, location-based map of UK infrastructure could be used to form an integral part of a digital twin of Great Britain: If this could be scaled up to a nationwide level, it would enable policy makers to more accurately plan monitor, predict and influence services like energy and smart transport.

Policy makers could identify the relationships between optimal economic or social outcomes and nearby infrastructure, and plan for effective upgrades. Everything from full-fibre networks to new rail lines could be built around boosting local healthcare or driving innovative new digital start-ups. Crucially, the impact of new infrastructure on local people and services and stress-testing of new networks could be modelled in the virtual world, before implementing them in the physical world.

More joined-up infrastructure planning through a digital twin approach would ensure systems worked together to deliver wider benefits. Research demonstrates that greater collaboration in planning and provision of services could save the UK economy £3 billion.

Achieving this vision will require a neutral convener of all sorts of infrastructure data, including location data. To facilitate this, all infrastructure data would need to be interoperable, easily shared and understood.

For more information see: www.ordnancesurvey.co.uk/blog/2017/10/digital-twin-new-*smart-city/*

Reference to Q.9

Case study: OS Net – a fundamental geospatial asset

The OS Net® network is the infrastructure which gives access to the national coordinate system of Great Britain.

The network consists of approximately 110 continuously operating, very precise Global Navigation Satellite System (GNSS) stations throughout Great Britain that stream the GNSS data in real time to a central server.

The server computes real time corrections to GNSS enabling OS surveyors to use GNSS at the centimetre level while updating the national map database. The data is forwarded to OS commercial partners who offer similar correction services. It's also archived and made freely available on the Internet.

OS Net makes the accurate determination of national standard coordinates much easier and more efficient for users who need accurate positioning, compared with traditional (pre-GNSS) methods. This technology supports an extensive range of mapping, engineering and environmental projects which would simply not be possible without it. Using a single receiver, a positional accuracy of 1-2 cm is achievable, depending on the equipment used and environmental factors.

For more information see: *www.ordnancesurvey.co.uk/business-and-government/products/os-net/index.html*

Case study: responding to customer requirements with the Open Zoomstack trial

OS Open Zoomstack is a comprehensive vector basemap showing coverage of Great Britain at a national level, right down to street level detail.

OS Open Zoomstack is designed to make OS map data more accessible and easier to use.

The advantages of Zoomstack include:

- The data is available in just one single data file and via an API. It is provided in easy-to-use formats to help customers to get started quickly
- The data is compatible with Geographic Information Systems (GIS), web, mobile and offline systems. It is highly customisable, giving customers the flexibility they need to complete their work
- Vector Tiles contain actual data (not just images) which can be interrogated and analysed. The high-definition mapping also renders quickly, giving a seamless experience

We use OS Open Zoomstack in our own mapping applications and we've had positive feedback from partners and customers who have participated in the trial.

For more information see: *www.ordnancesurvey.co.uk/zoomstack*

Case study: Geovation

OS is committed to innovation. Through the London Geovation hub, supported by both OS and HM Land Registry, we identify and invest in start-ups.

By encouraging small business growth, we are supporting Britain as a world leader in innovation, and expanding the use of geospatial data and technologies. Running a start-up incubator also gives us the opportunity to generate valuable insight on new technologies, markets and ways of working.

The world is moving faster, and we need to ensure we adapt to serve up our data rapidly for our customers. Geovation is a great example of where collaborating with new ideas and entrepreneurial energy creates space for fresh thinking. And it is the perfect place to explore how we can remain a forward-looking organisation.

For more information see: *geovation.uk*

Case study: OS data being used to predict coastal change in Scotland

The UK's Climate Change Risk Assessment (August 2017) anticipates that increases in sea level, coastal erosion and coastal flooding will affect Scotland's 'soft' coastlines and its coastal assets. Scotland's National Coastal Change Assessment (NCCA) aims to create a shared evidence base to support more sustainable coastal and terrestrial planning decisions.

The NCCA needed to establish what is erodible and what had already eroded. This was achieved by extracting the geo-rectified coastline position from OS 2nd Edition Country Series maps (1892-1905) and comparing it to both the 1970s and the current coastal position (updated by OS data, including coastal topographic data and tide lines and LiDAR datasets where available), to then estimate past erosion/accretion rates. Using the historic coastal change rates, the coastline position could then be projected into the future. Using the erosion rates combined with a number of socio-economic datasets, key assets at risk from future coastal erosion could then be identified.

Since the 1970s, 77% of Scottish 'soft' coast could move – but it hasn't. Meanwhile 11% of 'soft' coast has advanced more than 10 metres seaward, and 12% of soft coast has retreated more than 10 metres landward. If coastal change continued at these rates, the Assessment anticipated a 16% retreat and 9% advance over the next 37 years; more coast is experiencing erosion and that where it happens, it's twice as fast as before, putting many coastal assets at risk.

The NCCA's findings are informing existing strategic planning (Shoreline Management Plans, Flood Risk Management Planning, Strategic and Local Plans, National and Regional Marine Planning), as well as identifying areas which may remain susceptible in the coming decades, and therefore require supplementary support or protection.

For more information, including interactive maps, see: *www.dynamiccoast.com*

Reference to Q.17

Case study: OS data supporting the property and land sector

Across the land and property lifecycle there is critical need for location data, particularly in the siting and planning stages. A rising population, changing demographics, changes in buyer and social behaviours all impact on the demand and availability of land and housing. A lack of modernisation with across the land and property sector mean that productivity over the past 25 years, has grown by just 11%, in comparison to 41% nationally (ONS).

The number of 'Proptech' industries in the UK are growing, providing the sector with often niche solutions which address the specific market requirements of key players – estate agents, developers and surveyors. These companies are increasingly drawing on OS and other public sector data.

OS recently interviewed its partner community (including companies such as Landmark, Groundsure and Centremaps) to better understand the value they extract, their key tasks and their use cases for Geospatial data.

OS provides a range of low value, high volume property reports to support the lifecycle of land and planning which can be critical in due diligence processes, where inaccurate data risks corporate liability. OS geospatial data is used by our partners to support: site identification, site feasibility assessment, planning applications, 3D building modelling, and infrastructure planning.

We know that our partners value greater accuracy and the completeness of OS data. Value is attached to enhanced building attribution data, including: floor area, age, roof type, number of floors, construction type, and land attribution (classification, vegetation).

We know that our partners require improved accessibility, particularly through reliable APIs and FTP processes. OS is improving access to more useable data, for example by providing a portal for contextual mapping for Area of Interest or data attribution.

Our partners are also calling for improved standardisation and interoperability across government data sources. Greater value may be extracted from geospatial data if it can answer specific questions about, for example, flood risk or land availability.

There is an opportunity to open up the market to new users, as well as readying the market for the adoption of new technologies, which would improve land identification and feasibility assessment.

Reference to Q.18

Case study: OS data supporting financial services markets

The UK has largest insurance market in Europe and third largest in the world, generating 24% of Europe's premium income (Association of British Insurers, 2013). Furthermore, global IT Enterprise spending in the banking and securities market is set to grow 3% in 2018 (Gartner).

External influences and fraud are driving up risk levels in the insurance market. In addition, in June 2018, the Bank of England published a statement of policy for the Minimum Requirements for own funds and Eligible Liabilities (MREL), which is likely to lead to banks being required to reduce levels of risk. Accurate location data is used by both the insurance and banking markets to mitigate risk.

OS recently interviewed its partner community to better understand the value they extract, their key tasks and their use cases for Geospatial data. This research identified that partners in the financial services markets require enhanced capture of building attribution, including: volume, number floors, height, usage/classification, age, roof type, structure types, building foot print, internal building mapping, land attribution (use and cover, e.g. garden size); as well as more complete data about underground assets.

In common with our partners in the land and property sector, our financial services partners are also calling for improved standardisation and interoperability across government data sources. The solutions in this market are often complex, bespoke and able to integrate with existing business solutions/systems, alongside a range of data sources. Data analytics is prevalent in the financial services market particularly due to the analysis of data in the various risk models. Automating the completion of tasks such as calculating a rebuild cost, calculating flood risk, accurate flood modelling, calculating insurance premiums, or making decisions for mortgage lending, could lead to more cost-effective decision making in this key UK sector.

There may be an opportunity to better support financial services' risk analyses through making relevant public and private geospatial data available in a format which is interoperable, accessible and useable.

Appendix two: Recommended reading

- Ordnance Survey, Public Task (2015): ***www.ordnancesurvey.co.uk/about/governance/public-task***
- Ordnance Survey: *Everything Happens Somewhere* (to be published 29 October 2018) ***www.ordnancesurvey.co.uk***
- Geospatial Media and Communications, 2018, *Geospatial Industry Outlook & Readiness Index,* ***geobuiz.com/pdf/geoBuiz-2018-report.pdf***
- United Nations, Resolution, through to UNGGRF: A global geodetic reference frame for sustainable development (2015) ***www.unggrf.org***
- HM Government: *Place Matters: The Location Strategy for the UK* (2008) ***data.gov.uk/library/place-matters-the-location-strategy-for-the-united-kingdom***
- HM Government, Centre for Digital Built Britain: *Digital Built Britain – Level 3 Building Information Modelling - Strategic Plan* (February 2017) ***assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/410096/bis-15-155-digital-built-britain-level-3-strategy.pdf***
- National Infrastructure Commission: *Data for the public good* (December 2017) ***www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf***
- Open Data Institute: *The UK's geospatial data infrastructure: mapping the current challenges and opportunities* (October 2018)

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Ordnance Survey Northern Ireland - Land and Property Services
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**x**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

"Geospatial data" and "positional data" are generally synonymous—it is unclear why the terms are differentiated and may lead to confusion with regards to terminology, particularly if both terms are used in strategy/policy papers. Positional Data maybe renamed Relatational Data if location is a secondary purpose.

Positional data includes x, y and z (height) information only—should 4D (time-series data) be included going forward? Useful for long-term monitoring e.g. coastal erosion and predicting future needs and trends

There may be another 'type' here relating to the linkages and business process triggers that are made possible through the sharing, use and management of the lifecycle change of the identifiers

The identifiers are a way of anchoring a wide range of attributes to or about a place - not just linking position to geospatial. This doesn't explain the benefits properly

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Introduce GIS, mapping and spatial analysis early in education i.e. in primary school and continue through to university with specific inclusion in 3rd Level courses not traditionally aligned with geography (e.g., biology, computer science, politics and government, behavioural psychology, etc.).

Promote the incorporation of computer science and programming principles within 3rd Level geography curricula.

Explicit inclusion of geo-literacy in education boards' official curricula/objectives (e.g. make geospatial awareness mandatory from primary to 3rd Level).

Increase student support and access to GI-related courses and learning opportunities (e.g. cheaper GI courses, burseries, sponsorships, apprenticeships/placements, accreditation, etc.).

Include geo-literacy in curriculum/course objecives for those studying to become teachers (i.e., educate teachers). Schools both primary and secondary, where GI is included as a part of the curriculum. OSNI Academic licence (free for academic instruction) could aid this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Gaps in understanding computer science principles, specifically relational databases, web development and coding…these are not traditionally included as part of curricula for geography-related degrees—the majority of our staff have geography or geography-related degrees (see Q2 above regarding how this can be addressed in education). Furthermore, ICT gaps can be addressed by training; however access to training (as well as specialized software) is prohibitive. Promoting the development and/or access to low-cost and/or open source ICT-based training would be a solution.

Organization-induced separation of GI and ICT roles prohibit GI-based staff from developing computer science-related skills to augment GI skills (e.g. web app development)—the promotion and acceptance of computer science as part of GI staff's skillset would help alleviate this.

Basic understanding of cartographic principles (and related skills) seem to be declining as organizations (public, commercial, and even academic) rely more and more on digital visualization "templates" (e.g. web-based map viewers) to create aesthetically pleasing spatial analytical outputs. These skills can not be neglected in GI-related courses.

See question 2 to promote careers

Skills to enable efficient and accurate capture of imagery, DTM, DSM, NIR, LIDAR, Point Clouds
Skills to be able to capture and update databases using a range of methods, Field Survey, Mono and Stereo plotting, Drone survey and processing
Skills to enable the processing, storage and delivery of these large datasets
Skills to be able to manipulate, enhance, combine, query, this data with a wide range of other data to deliver new insights, improve and inform business processes.
Skills in setting up linkages to create multi-channel communications across a wide customer base to realise the value of geospatial identifiers

Use and enhance the NI Model of Mapping and Charting Grades and enhance the skills base (particularly database administration and IT skills) distributed across central and local government and build a sharing community of knowledge and expertise. Create a career path for this community similar to NISRA statisticians.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Addressing data is challenging because there is no mandate to specify the use of a single authoritative addressing dataset for a given region/area. Consequently, there are cases where an address has multiple “forms” (e.g. a road might be spelled different ways, or referred to differently). This makes it difficult to address-match related datasets and requires arduous, often manual, processes to achieve. By mandating or even promoting the use of authoritative addressing databases, we can fully leverage interrelated datasets to streamline workflows and services (particularly in the public sector).

Utilities—including sub-surface—datasets (e.g. gas, electricity, etc.) are useful for local and emergency planning; however access to these datasets are minimal. Promoting increased access to—at the very least—basic utilities data would enhance public services and service delivery processes.

Datasets need to be maintained at a level of quality that make them useful (i.e. they need to be QA/QC’ed and managed properly); otherwise, their utility would be limited and could lead to poor (or wrong) decision-making. Data creators need to be incentivized to increase access to data without sacrificing data quality.

A single definitive address is by far one of the practical and useful pieces of work that could be delivered by the Geospatial Commision

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Standardized and authoritative addressing datasets are necessary to support any emerging technologies. Without standardization, information linked to the same location but referred to with different addresses/designations can not be fully utilized.

Intellectual property (IP) embedded in current addressing systems (e.g. Postcodes) limit access to addressing datasets (e.g. royalties/fees make using authoritative datasets cost-prohibitive). Attributes that are integral to addresses (e.g. Postcodes) should be open.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

Promote and enhance access to EO data. Develop an adequately sign-posted, accessible, centralized repository of authoritative EO data. Currently, it is difficult to identify appropriate and accessible EO data.

The UK must promote and develop its own EO platforms—particularly in light of Brexit.

The UK must promote and incentivize UK-based EO data/platform developers to enhance EO capabilities and make outputs more open to the public sector.

Seek to provide access to higher resolution imagery

Most of this data comes in standard formats and can be managed in existing software. One of the main problems with this data is storage and fast access to that storage. A significant opportunity would be to provide a cloud based infrastructure to store and provide fast access to 'the single source' for the full range of core geospatial datasets.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

IOT and Drone technologies should be promoted—but equally important, STANDARDS for data outputs to ensure they can be leveraged by users regardless of which IOT/Drone platforms they were initially derived from.

BIM/3D modelling technologies and data outputs need to be developed within a standardized framework—again, to ensure data interoperability.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Standardization of data is necessary to support any roll-out of future technologies. Due to the fast and dynamic changes in data capture technology, standardization and data interoperability is a fundamental method for future-proofing geospatial data.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The UK's Geospatial data is ranked second in the world in respect of quality, currency and completeness. This standard of authoritative state sponsored data can only be sustained by continued maintenance, development and enhancement funded by a 'user pays' cost recovery business model

Revenue generated through licensing to government departments and large businesses should be used to invest in the maintenance and development of high quality, authoritative datasets. This should also be used to offset costs associated with making datasets more accessible to small and medium enterprises.

Promotion and development of standardization methods coupled by mandates/ enforcement of these standards.

Public sector staff need to be supported to develop skills and resources to ensure sufficient knowledge of best practice methods/standards.

Promotion and development of cross-departmental technologies (e.g. centralized data stores and spatial data infrastructures that facilitate cross-departmental workflows) and staff skills to harness those technologies.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Common Standards for all of the above including BIM, 3D, and linkages between the two – to be developed and prioritised.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector e.g. utilities must develop and maintain datasets to the same (if not higher) standards as public bodies to ensure data interoperability.

Greater sharing of information collected by the private sector could enhance existing datasets and reduce duplication of effort.

Encourage the release of private sector data to the public domain. Additionally, private sector data created/generated as part of public-funded works must be released to the public (or at the very least released to the government body funding the works) BY DEFAULT. Promote—if not mandate—access to public private partnership-based datasets.

Utilise the geospatial identifiers supplied and maintained by NMAs

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The implementation and use of GUIDS is crucial to improve the interoperability of geospatial data across the UK

Standardization and linking public sector datasets must be encouraged (if not mandated). The use of standards and identifiers to ensure data links and interoperability will increase the value of public sector data.

Supporting public sector efforts to increase data quality processes and methods is integral to optimizing data viability—be it financial support, increasing access to training/knowledge transfer, best practice, standardization, etc.

Develop, promote and support central government data stores/platforms via coordinated sign-posting/marketing/communications strategy, as well as political support and financial resources.

Increase access to utilities and utilities-related datasets to enhance local development planning.

Support local government (Local Councils) in their efforts to leverage GI and spatial datasets.

Mandate a framework for data sharing agreements between public sector bodies in times of emergency events when access to sensitive datasets is required.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Ensure the scope and remit of GC is appropriate and that GC has sufficient capital to fund initiatives and also remit to enforce standards and promote best practices.

GC should also make data-based legislation more accessible/understandable to public sector staff/bodies who are tasked with meeting these obligations (e.g. support local/regional government with EU INSPIRE Directive compliance).

Assist with 3rd party Intellectual Property (Royal Mail) in addressing datasets allowing better use to be made of the addressing datasets with fewer restrictions.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Ensure that the focus for spatial data INCLUDES MARINE/AQUATIC data as well as land/terrestrial data. At the moment, there is an over emphasis on land-based spatial datasets and neglect for water-based datasets (e.g. benthic datasets, water column [3D marine] data, etc.).

In Northern Ireland, cross-border datasets are integral to public services; so enhancing cross-border collaboration and supporting facilities, technologies, and data workflows with the Rep of Ireland should be a priority.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

GC should seek to develop a core UK Strategy and in a federated approach the devolved administrations should seek to align their regional strategies to it.

It is difficult to envisage that there could be an effective and properly focussed single UK strategy

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Include Local Government in the UK and regional strategies

High level strategies must include local councils who should be encouraged (if not mandated) to prioritize geospatial data, workflows and processes within local council work plans.

Support for local council staff via info-sessions as well as access to geospatial training and resources.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Drone and 3D datasets should be scaled-up and made more accessible (e.g. cheaper data products).

Use of Geoanalytics tools/applications to leverage crowdsourced and/or commercial datasets (e.g. Facebook data, VISA credit card locational data, etc.)

Q18: Are there any other areas that we should look at as a priority?

Promoting geoliteracy in traditionally non-GI based government departments (particularly at the senior management level) to enable them to leverage their datasets within a spatial context and increase/release value and efficiency. For instance, some NI Executive Departments have minimal understanding of how geo-enabling their datasets can increase their utility and effectiveness in decision-making and service-delivery processes.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Mobile-based data technologies (including UAVs) are rife with regulatory challenges (e.g. privacy).

The use of AI and AR for public services also have geospatial components with regulatory issues that need to be worked out (again, privacy).

Smart Cities project has been facilitated through the free access to OSNI mapping using the no cost OSNI Innovator Licence for development purposes.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Active participation in international spatial standards groups (e.g. Smart Cities Standards) is necessary to ensure UK's geospatial industries develop in line with (or ahead of) the rest of the world.

Active development of UK's earth observation platforms(s) and support for related/dependent small businesses and government bodies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Eurogeographics standardise and join 43 Countries geospatial data to international. They are an easy single point of contact to compare and contrast the work of the national mapping organisations within these countries.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	(1) Police PURG Rep / Gwent Police (2) Avon & Somerset Police ***On behalf of all Police Services in England & Wales***
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**X** **Police (Emergency Service)** *On behalf of all Police Services in England & Wales - responses collated and fed through this questionnaire.*

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

As a police service, we agree with the overall definition however we believe it requires some clarifications in order to ensure the geospatial data types **include** (i.e. do not omit) the following specific data sources:

- ***Live*** **positional data (i.e. GPS) in point (2):** relating to objects in movement such as vehicle tracking (e.g. ship, plane, HGV, cars [which may derive from a black box]), smart phones or airwave devices, electronic tagging, etc.
- **"Passive data" in point (2):**
    - This is relating to the use of spatially referenced objects / services from which we can derive location of "users" at a specific date and time. For example: use of phone masts whilst using telecommunications; vehicles being registered through Automated

Number Plate Recognition (ANPR); credit card usage at ATM or shop; Oyster card use at tube stations, individual on CCTV footage.

- This is going to be an area of geospatial data growth in terms of generation but also for consumption, especially within the police service when it is required to identify the location of individuals as part of an investigation.
- This may need to be regulated – if so by whom? Geospatial commission?
- Currently it is provided by service providers (e.g. telecoms company etc.) in a variety of formats and coordinates (e.g. eastings and northings; lat / long decimal values; lat / long in degrees, minutes, seconds. The variety of coordinate's formats makes it daunting for novices and less accessible than it should be. There is scope to set UK standards for these companies too.

In addition to the above specific data sources, we believe it is important that the following two are also mentioned and clearly stated in the definition:

- **Geospatial Web Services in point (4):** it is not clear that the services providing geospatial data as an **input,** such as Data as a Service (DaaS), are included – *it seems to refer to analytics therefore "output" products.* We believe that the way Geospatial data is being delivered and the way in which it is consumed, is an important and growing aspect of geospatial data types.
- **Geospatial Data formats:** This could be added as there is a strong requirement for interoperability of data and compliance with OGC standards; with also a need to influence suppliers in adopting / allowing the consumptions of those formats.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

As a Police Service, staff in charge of the "Geospatial portfolio" in the various police forces are from a variety of backgrounds and therefore, systems are set-up in very disparate ways – with sometimes no GI expert at all. For example, staff may have a background in IT (developers, DBAs, etc.) or policing (ex- Police officer). In addition to this, with budget reductions, vacant GI posts are often not replaced and the number of GI professionals in policing is decreasing. This makes it challenging for police forces to embrace geospatial capabilities in a uniform way – geospatial data may not be kept up-to-date and the potential of geospatial data and applications are not realised. It also hinders innovation.

We believe that there are a number of ways the Geospatial Commission can help GIS capabilities in the future:

(N.B: some of the points below do not only refer directly to police service.)

(1) Skills / Pathways:

- Improve the range of GI qualifications (i.e. not just university degree) for young people but also to scale up to current GI professionals
- Availability of a range of accredited skills / pathways to prove capability and recognise acquired experience and skills (e.g. RGS chartership)
- Increase incentives for GIS apprentiships / internships: current recruitment requires a lot of experience, often too focused on traditional GIS skills like digitisation etc. There needs to be routes to acquire a more rounded business skills – where understanding the business and its applications of GIS will drive continuous improvement.
- Improve the provision of low cost workshops / training for GI professionals and users in a way that is not driven by suppliers but rather by the needs of the users.

(2) Promote GIS and geospatial data nationally

- Raise the profile of GIS nationally for all sectors = e.g. utilise **GIS Day** as an opportunity
- Actively promote GI as an enabling service that is holistic and accessible to all, not just limited to specialists / expert practitioners
- Widen the scope of (and normalise) geospatial, to demonstrate there is more benefits to gain than just the traditional “niche” analyst type role
- Promote geospatial and the use of GIS in schools within different strands of the curriculum: i.e. not just as mapping in geography, but as a IT skill or as a problem solving tool in science, history, etc.

(3) Increase buy-in and demand for GI Skilled jobs:

- Educate Top Executives of large employers (including in the public sector) on the benefits of investing in GI teams for data creation (e.g. LLPG custodians) and data consumption (GIS teams) to ensure recognition that the roles are needed within organsations.
- Tackle the “mystery / too hard to understand / too technical” stigma of GI tools / roles at senior management level

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As mentioned in Q2 above, GI professionals in the police service come from very different backgrounds therefore geospatial skills / gaps can be very different.

Nowadays, challenges faced require a blend of different skills from a range of roles (GIS technicians, geographers, cartographers, database administrators, programmers, developers, analysts…) alongside a sound understanding of the business and how to use GI within it. Also with the growth of software providers (private or open source) and formats, there is also a requirement for GIS professionals to be conversant in many applications / formats / programming languages.

Often, in the police service, the GI portfolio is given to only one individual servicing one or more organisation(s) (e.g. alliances) with sometimes different systems and applications. Finding these rounded and holistic skills in a single individual is extremely rare and therefore unlikely.

It is also a huge **resilience** issue and in turn, skills are never achieved if under-resourced.

(1) **Gaps:** Below are some examples of the current gaps / needs found in our organisations:

- Geospatial basics (e.g. Gazetteer / GIS skills) for those who come from a non geo-spatial background, e.g. IT backgrounds
- Training for geospatial content editing - understanding topological and geometry checks (e.g. digitising polygons with no slivers / overlaps)
- Database administration and programming skills for GI professionals that are coming from a geography background
- Understanding of Open Source packages, formats, and standards
- Basics of Open Data and the standards surrounding this (not known in the police service due to traditional culture of dealing with sensitive / personal information).

(2) In **order to address this**, ideally you would require:

- A team or a pool of individuals (as opposed to one!) from various backgrounds and with various sills working as a team in GIS to be able to harvest all skills necessary
- Recruiting based on attitude to learning and lateral thinking is also key to invest in individuals who are able to adapt to rapid changing technologies and big data
- Appreciation of GI capabilities at a senior level **securing investment** in team / staff – *this does not have to be in each police forces but could be shared services such as more regional*

/centralised team or centres of expertise supporting various GIS functions / or police service accross the country

- There is also often a lack of **ownership** of the GI portfolio within individual police forces. Often because it is not understood, or because police officers turnover is high due to promotions. The lack of staffing means that there is limited visibility as well and the agenda is rarely pushed forward.
- Working with education and higher education to teach the right skills for a GI career. At the moment universities still teach traditional GIS skills such as:
    - how to use Desktop GIS,
    - problem solving applied to human or physical geography,
    - GIS technologies rather than new GIS methods as used in the real world.

(3) Promotion of GI careers:

- Recognition of GI roles at all levels of the organisation
- Standardise where GIS sits within an organisation so that there is a clear career path and organisational structure to enable development\promotion opportunities. Is GIS located in the right department to maximize GIS investments and operational efficiency?
- Make a GIS career an attracting option by offering salaries that are actually commensurate with the skills and experience required
- Better sharing of outstanding / innovative GIS work with benefits gained from these.

We believe that this quote summarises the importance of investing in GI staff within the geospatial industry:

"No GIS can be a success without the right people involved. A real-world GIS is actually a complex system of interrelated parts, and at the centre of this system is a smart person or team who understands the whole."

Dr. Roger Tomlinson. Thinking About GIS: Geographic Information System Planning for Managers, 5th edition. ISBN: 9781589483484.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

(1) Accessibility vs usability vs interoperability

A large range of geospatial datasets are available to the police service (from Ordnance Survey, Lidar from Environment Agency, as a few examples) however, although easily accessible, they often cannot be utilised due to a range of issues:

- Datasets are in a format that cannot be readily consumed in the GIS software used
- Datasets are not provided as a web services which could be readily consumed within GIS software. *N.B: there is also a need however to have "offline backups" – this is particularly the case for Command and Control systems accessing web services. Ideally "live feeds" should be our goal – but security, stability and worries about viruses / systems falling over, prevent trailblazing these technologies for use at the sharp end of policing.*
- Datasets require large amounts of pre-processing in order to be used, lack of resources mean this data becomes unusable, for example:
    - To create a 3D building layer, OS MasterMap has to be downloaded in gml per tile, this data then needs to processed and transformed (using ETL) into another format, building height has to be downloaded separately in order to cross reference the information and allow for the extrusion.
    - This also applies to ONS demographics data which is shared at a geographic level (e.g. Output Areas [OA] or wards) – the OA / ward layer needs to be downloaded separately to the OA / ward excel sheet. The excel data is merged to the OA point / ward boundary and only then can we calculate the aggregation of population for our own geography.
- Datasets are in a standard that the suppliers are slow to adopt – therefore we have to wait on our suppliers to make the necessary change to be able to use it (e.g. this was and is still the case for Address Base).Additionally, police forces are often lacking the budget to upgrade / replace systems required.
- Datasets are not fit for purpose for police / emergency service use: e.g. AddressBase relates mostly to addressable locations however a large proportion of crimes / incidents etc. occur outside an address e.g. street junction, at the bus stops or taxi ranks, etc. (see Q5 and Q17)
- Require additional information at additional cost (e.g. OS Highways – speed data; AddressBase – Business Names)
- Datasets are not readily usable with the Contingency Planning & Emergency / Disaster Response systems of choice **Resilience Direct**

(centrally funded) which is available for all partner agencies to share and view data in a one common system. Ideally all geospatial layers required for police use and emergency responses should be readily available within Resilience Direct.

(2) Improvements required

- Due to the varied software limitations, consumers require the data in a range of formats; also to view / download or consume as web services / APIs to cater for everyones needs.
- Data standards and good practice, as well as robust metadata are required to identify data quality / currency / timeliness – to ensure there is trust in the data
- A single repository / access point for all information would be an ideal way forward, removing the need for individual data sharing agreements, mandating open standards and formats, metadata etc. (as a minimum, there would need to be templates & guidance for data sharing)
- Key geospatial identifiers (such as UPRNs) need to be promoted / mandated as standards of recording locations in all sectors to allow easy combination of diverse data sources, as well as sharing data
- Realising the value of data to monetise it, requires consumers / developers to rely on quality, consistency, and up-to-date data (accompanied by metadata and support) on which to base apps, services, tools and analysis.

(3) Specific Datasets:

- **Transport infrastructure** (such as bus routes & bus stops, train lines & stations, tube lines & stations, tramway lines and stops): within London, TfL is ahead of the game in creating and sharing the information, however sometimes the information can be hidden away. In the rest of the country this is very flaky. Often due to the subcontracting of the data (e.g. bus) and therefore not accessible or poorly digitised.
- **Electoral Roll:** the police service currently relies on private sector partners to supply this information (matched to UPRN and AddressBase). This is also captured by local authorities and some process could be put in place to ensure the information is linked to UPRNs at source, as well as being provided as an extra dataset centrally and as part of a government agreement. This could release significant cost savings.
- **Passive Data coordinates standards**: mobile telephone and ANPR data is available but is supplied in many different formats, even using different

versions of Lat/Long, meaning complex GIS processes to import and use the data – making it less accessible than it should be. Mobile phone mast data can also be shrouded in secrecy and commercial confidentiality – these standards should be improved and openness encouraged via a central agreement (see Q1 – passive data).

- **Commercial geolocation for Emergency / Disaster response**: better integration with commercial geolocation data (e.g. Facebook Disaster response, Google Person Finder, etc.) would be useful in order to understand the personal impact of incidents; but also mass search of individuals in a disaster scenario.
- **National infrastructure & services**: e.g. gas, water, electricity, sewers, disused tunnels. This is lacking at the moment.
- **Demographic datasets:** it would be useful to have high-level demographics already geospatially referenced and downloadable via the ONS geoportal. For example, some key statistics like total population (with gender, age, and ethnicity breakdown), deprivation, or segmentation to avoid the processing duplication required to use the data.

N.B: this is only a fraction of the data required… we would love to have accurate, consistent and up-to-date locations such as CCTVs, Telecoms masts, etc.

The list would be too long for this question.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

(1) Address Base is an essential geospatial data source to police service

As a police service we have mostly migrated to use AddressBase for linking crime / incidents to a location. Correct addresses are a key element of crime / incident / intelligence data quality and enables the:

- Accurate referral of cases to partner agencies and services (e.g. victim support, crown prosecution service, probation, etc.)
- Display and visualisation of crime / incidents / intelligence in turn enabling a better response, understanding of short / long-term patterns and ability to provide prevention measures
- Review and granular reporting of performance, allowing for a culture of continuous improvement

- Sharing of information (police.uk)

However, we face many issues relating to AddressBase products which mean not all the above can be achieved effectively. We believe we are still a long way off achieving a fully standardised address database.

(2) Improvements required

- **Disparity between local custodians**: Police forces often pan across many local authorities and therefore experience first-hand the discrepancies in the standards of recording – specifically:
    - Variations in the use of classifications codes, but also mandating the granularity of the classifications codes. We rely heavily on this to extract locations such as care homes, schools, etc.
    - Varying choice of nomenclature, different interpretation of the Data Entry Convention Standards (DEC).
- Addresses are only a fraction of where crimes / incidents occur there is a requirement to have consistently **recorded non addressable locations** such as (*non exhaustive list):* See point (3) below.
    - CCTV cameras operated by local authorities (some include, some don't)
    - Road junctions: OS highways can derive road junctions. Point road junctions are necessary for the police to record road collisions so by including within AddressBase Premium, the data could be consumed through our gazetteer systems the same way other locations are consumed.
- **Street Naming & Numbering** (SNN) legislation is not fit for purpose, resulting in different behaviours between creating authorities which in turn produces different quality address data. Default recommendation should be to integrate the SNN function into the Gazetteer management team to provide a single point of contact and expertise, again resulting in better quality and more consistent addresses. This would give local services a lever to challenge outdated entrenched internal behaviour.
- The **cross referenced Royal Mail Address** (PAF) in AddressBase includes incorrect information and there is no requirement for them to makes changes when the error is fed back to them. This adds data quality issues and confusion amongst users, especially those who don't understand the addressing systems and who will tend to choose Royal Mail as the correct data (even though it is not).
- The level of **complexity** of the AddressBase Premium product (relational database) can be daunting for some. This also relies on police forces to

procure systems to handle the data in the format required – budget limitations mean this is not always possible.

- **Promote AddressBase as the single source for address data.** OS make the claim that 'Points of Interest' is the most comprehensive, location-based directory of all publically and privately-owned businesses, education and leisure services in Britain. Surely, this should be AddressBase.
- Enforce **UPRN** as a mandatory requirement for address information sharing.
- Invest in **address subtypes** for ease of information retrieval. For example, Children's Home – Local Authority, Children's Home – Private, Social Housing.
- **Capturing change of Commercial / Business Names**:
    - The **lag and/or absence of current business name data** as well as the consistency of how this data is held is an issue reported by each force a simple means to capture / report new business names to custodians so they can rapidly update changes would be a key benefit for all address users.
    - The **long delivery cycle of AddressBase updates** (COUs) on a 6-week basis is often in reality translated to a 12-week delay from the date of the actual LLPG update of the address. In this period, many business names change and those changes are then not available to Command & Control call handlers. The current COU process may be acceptable for commercial purchasers however not for emergency services. These delays mean police forces create work arounds which in turn cause issues and additional work there is a key requirement to set up a system where emergency services receive a daily AddressBase update.
    - It has been noticed that in large towns and cities, open products like Open Street Map are often more up-to-date than AddressBase and also products like OS Point of Interest.
    - It is often wrongly assumed that business rates departments record addresses and details of businesses and pass this information on to the LLPG custodians in their organisations.
    - There is a strong requirement for a **universal "record" of business names t**o be created and maintained, free at point of use. This should mandate the accurate use of the UPRN and only record the business name at the location of the business itself (a different classification could be used for residential premises used for a

business?). It would also encourage a single view of an address for a business - at the moment a business can legitimately have a different version of its address than the official one recorded on the LLPG/NAG.

(3) Additional Data required in AddressBase for the Emergency Service

As explained above, there is a requirement to collate additional locations beyond just addresses within AddressBase, and to be at no additional cost.

- **Type 3 Streets and Junctions** – see initiative which has begun with Ordnance Survey / Geoplace at the request of police forces.
- **Features referring to another**: There are 'pond' addresses that refer to being 'x metres' away from another feature or a premise such as a farm, when the farm itself (or the feature) is not included as an address in its own right.
- There is a need for central guidance for best practice to help local authorities argue the case internally to adequately resource both spatial data and gazetteer maintenance.
- **Big national infrastructure companies** (e.g. utilities) should be contributing their geospatial features in AddressBase to integrate this data centrally, e.g. telecom masts, sub-stations. This would avoid the duplication currently experienced (e.g. electricity substations are sometimes added by local custodians, then duplicated from OS).
- There is a requirement for local authorities to see how widely and essential their data has become to services across Britain, and that it is no longer just for a tax collecting purposes. The focus and the use of the data is now fitting a wider purpose and this should be reflected in the collection of non-addressable locations.
- **Creation of a Emergency Services Gazetteer & features.** If there is a desire to keep the main AddressBase product focused on properties, establish parallel supplies with the additional information for consumption by anyone who needs to share these key locations – for example, an emergency service gazetteer. This could build on the existing data supply, including data from identified definitive sources to increase consistency and minimise the additional burden on local authorities.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

This is a new area for police forces, however there may be some scope in utilising earth observation data more effectively in the police service. Below are some ideas:

- Using good quality and high resolution satellite imagery which may be more up-to-date than the aerial imagery which requires a plan to fly it
- Use of live feeds of satellite data to support major incidents / disaster responses
- Using remote sensing as an additional tool with aerial or drone imagery, due to:
    - Autonomous operation (reduced constraints on line of sight)
    - Weather and night capable
    - Multiple sensors
    - Cost minimised – e.g. if thermal imagery was enabled – it could save sending helicopter out which is very costly
    - Safety (no risk over populated area) – e.g. policing festivals, large events

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

As a Police Service, we believe that the Geospatial Commission can:

(1) In the first instance, provide focus on technologies that **simplify the downstream ease of consumption** of reliable data, as such:

- Web Services and centralised data centres
- AI and machine learning to acquire, clean, process and derive enhanced new datasets from big data (e.g. understanding people's movements, etc.)

(2) **Enable the demonstration of capabilities / art of possible**:

- Drones / 3D modelling and visualisation
- Virtual / Augmented reality (e.g. for training, and response in poor visibility conditions; to flag risks, etc.)
- Voice Activated Services (e.g. Alexa, Siri) – Where is my nearest…? Please call my nearest ….

(3) Lead/ encourage growth of alternative competitive solutions

- Open Source integrated GIS platform (including web)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

As mentioned in previously , use of geospatial data and applications in future technologies depends heavily on:

- The quality and timeliness of geospatial data is key for enabling use and trust from developers of future technology.
- Standards compliance and security is needed to ensure the above.
- Access and availability is also key.

However, without a sound infrastructure to consume these datasets / applications – future technologies won't be able to use them. There needs to be a comprehensive network dedicated to **high speed connectivity** across the country and not limited to high populated areas. By connectivity, we mean:

- Adequate Phone coverage (4G and now 5G rollout)
- High speed broadband / bandwidth: whilst this is a government priority, it is very slow to be delivered
- Increased open WiFi hotspots

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

As mentioned in Q3, GIS professional numbers are decreasing in the police sector but also in other public sectors. Whilst geospatial data use is booming, the numbers of staff creating the datasets is decreasing and stretched.

These stretched resources cannot provide the best geospatial datasets, or outputs. They don't have the time to educate / advocate GIS within their organisation. The function then becomes less visible and misunderstood.

We would hope the Geospatial Commission can influence the below:

- Secured / ring-fenced funding in organisations for minimum staff enabling the resource of both:
  - core basic GIS functions (e.g. LLPG, GIS officers)
  - And a senior GIS champion to promote the capabilities within the organisation.
- Mandate the requirement for each public sector to provide GIS capability (thus secure GIS jobs).
- Mandate that the strands from the new National Geospatial Strategy strands are included in individual organisations' digital and IT strategies.
- When investment / procurement is made in software providers (not just GIS software but all software using geospatial data), mandate the compliance with GI and OGC standards (e.g. addresses must comply with BS6777 standards) – i.e. a must to receive the contract / investment.

- Access to central resource pool / encourage collaboration to encourage resilience. Ensure this is not at the expense of being isolated from the business – remove duplication.
- Create a sense of pride and competition within organisations by incentivising the growth in geospatial maturity of the organisation – for example, organising awards to encourage demonstrations of innovation in GIS – need for both carrot and stick approaches.
- Establish / subsidise a large UK geospatial conference which encourages sharing of good practice, where people can learn from their peers, etc. without being tied to a specific private supplier. – e.g. GeoPlace, esriUK conferences. AGI, FOSS4G, UK Mapping Festival etc. are all paying events, so therefore do not show a great turn out. Public sectors have no budget for sending staff to payable conferences.
- Encourage more case studies to be shared in order to show what can be achieved.

We believe organisations should both be given incentives, and sanctions when required.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

In the police service, we are subject to data being provided in many coordinates systems, and in many formats. Converting batch lat/long coordinates to easting & northing is the most frequently asked questions by our users. Unfortunately, the various forms of recording lat/long (decimals, vs degrees, min, sec) can also confuse general users.

Through this exercise, it has noticed that there is a **lack of knowledge** about the free standalone coordinate converter tool provided by OS (**GridInquestII)** amongst police GI professionals themselves:

- More promotion of the tool should be done.
- An update of the GUI and an easy step by step guide would be useful too.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We believe the private sector should play a large role, specifically:

(1) Innovation & skills

- Enabling Research and Development into future technology using the data available (e.g. large GIS companies)
- Leading / Advisory role (e.g. large GIS and consultancy companies)
- Training

(2) Infrastructure

- Improve connectivity: e.g. improve 4G\5G coverage, especially for emergency services, as well as broadband speeds, and WiFi hotspots.
- Utility companies to share information / notify LLPG with new assets e.g. ATMs, telecoms masts, etc.

(3) Software developers / suppliers

- Suppliers to adapt to change in data standards quickly (e.g. AddressBase) in order to add value to the software (as opposed to charging for the change), thus avoiding pitfalls of being stuck with legacy systems that can't adapt to new and emerging technology.
- Be engaged with developing common data standards and services, and get rewarded (endorsement) for contributions and commitments to those standards.
- Enabling easier data sharing through ensuring connectivity, safety and security, and allowing wide use of web services.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

While some data is of known quality, maintained and delivered from a single location, this is not the norm. There is too much diversity in how datasets are captured, maintained and published or shared across the public sector.

There is a greater need for standards applied to key datasets with a minimum publication standard.

Areas where value and leadership can be added include:

- There needs to be a wider range of delivery method, formats (interoperability) and readily consumable web services (e.g. WFS, WMS, REST services, APIs).

- Common standards in using unique identifiers to record assets (e.g. utilities, schools, even our own estate departments!).
- Common standards in using unique identifiers (UPRNs) to enable more frequent sharing of information between partner agencies (e.g. markers, flags, risks, alarms) – which can be easily and automatically cross-referenced and therefore minimise the risk of errors.
- There are some challenges in gaining data at point level (address) from health organisations.
- Procurement contract have to include the need to meet geospatial data standards.

For example: for a given dataset, have a minimum defined product, published in defined formats which would allow moderation of compliance and compilation to a single dataset for easy consumption. For users of the data, and to encourage contributors, a compiled summary view can highlight who contributes, if there are any gaps and when the data was updated.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We believe the Geospatial Commission can help the public sector by:

(1) Establishing a new flexible mapping agreement

As a police service, we have felt the change in the geospatial industry and experienced how the public sector is very slow in reacting to it. The current PSMA is also demonstrating how inflexible the contract is and how we are served with a set of products. It is currently most unsatisfactory as it leads to end user groups investing considerable time, effort and frustration over very protracted timeframes, having to 'beg', 'badger' and 'cajole' to chase obvious enhancements. Whilst these will undoubtedly deliver real world saving and benefits many are still undelivered (ref. to the street junction work - emergency service gazetteer).

The new public mapping contract / agreement needs:

- To have a flexible framework and governance to manage evolving needs rather than a product based fixed contract.
- To include the means to force / leverage delivery of changing needs (pick & mix)

(2) Effectively gathering and using public sector stakeholders views:

- Carry on the great consultation work (like PSMA event).
- Maintain involvement of PURG / GISG.

- Include GI professional secondments from various sectors to Geospatial Commission to contribute and work on projects.
- Allow for a threat / risk matrix view of requirements by public sector consumers (i.e. low voice for single agencies as opposed to lots of weight from local authorities as large numbers).

(3) Enabling a central centre / repository of expertise and data

- It would be beneficial if the GC could exert authority to obtain additional datasets whether from public or private sector (i.e. public sector could build a business case which is taken on by the commission) – *possibly free of charge for emergency services.*
- Collate / publish materials on good practice / good business cases so senior ranks and managers can appreciate what is possible and help to understand need.
- Allow for a bank of skilled professionals to offer support to public sector / organisations with skill gaps.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Some ideas of additional datasets that would be useful to the police service (see Q4) - *(other than the improvements and additional features within AddressBase):*

- **Transport infrastructure** (such as bus routes & bus stops, train lines & stations, tube lines & stations, tramway lines and stops): within London, TfL is ahead of the game in creating and sharing the information, however sometimes the information can be hidden away. In the rest of the country this is very flaky. Often due to the subcontracting of the data (e.g. bus) and therefore not accessible.
- **Electoral Roll:** the police service currently relies on the private sector partners to supply the information (matched to UPRN and AddressBase). This is also captured by local authorities and some process could be put in place to ensure the information is linked to UPRNs at source, as well as being provided as an extra dataset centrally and as part of a government agreement. This could release significant cost savings.
- **Commercial geolocation** for Emergency / Disaster response: better integration with commercial geolocation data (e.g. Facebook Disaster response, Google Person Finder, etc.) would be useful in order to understand the personal impact of incidents; but also mass search of individuals in a disaster scenario.

- **National infrastructure & services**: e.g. gas, water, electricity, sewers, disused tunnels. This is lacking at the moment.
- **Demographic datasets:** it would be useful to have already high-level demographics already geospatially referenced and downloadable via the ONS geoportal. For example, some key statistics like total population (with gender, age, and ethnicity breakdown), deprivation, or segmentation to avoid the processing duplication required to use the data.
- **DTM, DEM, and Lidar**: We are aware it is currently provided by the APGB… however it would be good to have it as an easily accessible format e.g. a web service which enables the draping of data on top of it / extrusion of datasets in 3D when draped on top of it.
- **Building Information Modelling** (BIM) models to be available in a suitable / usable / interoperable form of large buildings (e.g. stadiums) and infrastructures to help integrating with GIS 3D visualisation for event planning / responses or contingency planning / disaster responses.
- **Aerial imagery** / **Satellite imagery**: is important to add operational context – not to be lost in the PSMA contract *(N.B: internal communication within the police sector is ongoing to promote take up).*
- **Planning – Basement development.**
- **Land Registry data** (land ownership) without having to pay or request separately to land registry.
- **DVLA data** linked to UPRN so we can link addresses of vehicle registered keepers.
- **Road Network (e.g. Highways):** Speed information should be included as standard in the OS highways Network.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

As a police service, we welcome a UK National Geospatial Strategy which can lead a common vision with agreed key objectives / strategic strands. This can then be adopted and developed locally within regions, but also across various sectors.

For this, we believe the GC needs to:

- Review / scope already written national / regional strategies:
    - Highlight similarities which can be adopted in the single strategy

    - Identify and acknowledge current areas of local differences
- Work on a proposal with representatives:
    - Propose and consult on a common vision and key strategy strands
    - Create a national strategy that will drive / be included in local IT / digital strategies
    - Set some key minimum national standards within local organisations (i.e Basic Minimum Requirements), still allowing for innovation.
- Test / Review:
    - Establish a technical pilot for this framework to test how this would work
    - Identify a few key datasets to provide an effective pilot and undertake this work end to end
    - Review regional progress and validity of the national strategy through grassroots' results
- Keep the strategy alive through annual review, adapting to technology changes / progress and highlighted challenges.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

We believe local authorities' work needs to be in support of the Geospatial Commission vision, objectives and mandate.

The existence and quality of the addressing datasets are testament to what can be achieved, the governance model and resourcing in place to drive this is an essential component of marshalling so many disparate bodies to produce usable end products.

There is a case that to deliver on spatial data will require similar governance, drive and co-ordination.

(1) Key principles and success factors to be applied to the creation, maintenance, co-ordination, monitoring and needs matching of spatial data are:

- Standards
- Best practice
- Submission and publication framework
- Monitoring and reporting
- Statutory / contractual obligation

(2) How to ensure there are local resources to undertake the work?

- Help with funding of GI / LLPG roles (stretched resources currently with some councils struggling to survive)
- Use the best channels to communicate with practitioners - national conference, governance structure, demonstrable benefit, etc.
- Awards and communication about innovation in public services
- Sanctions when appropriate when investment in capabilities and delivery of geospatial data is not adequate.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As a police service, we recognise that the economic value in these categories is clear however there is an additional category with a huge intrinsic value which is missing: **protection of life.**

(1) Multi-agency Incident Transfer

- Extensive work has been undertaken to pilot and prove the benefit case of electronically exchanging incident information between emergency services and local partners. In addition to major incidents, it is a framework for exchanging information between partners needing joint response or shared intelligence on locations.
- A detailed study and proof of concept pilot was sponsored by Cabinet Office, Welsh Government and ACPO members from both the emergency services and the commercial sector to look at the problem of exchanging incidents between agency control rooms.
- The link below gives fuller details of the work to date - https://www.geoplace.co.uk/-/the-uprn-underpinning-the-multi-agency-incident-transfer-mait-standard

(2) The creation of an Emergency Service Gazetteer

- Wide scale adoption of AddressBase across the public sector is a tremendous endorsement in the quality and coverage and is testament to the work invested in developing it.
- Adoption by emergency services has identified additional datasets of importance to delivering the public protection role, it has re-enforced the need for additional information to be captured and made available without compromising the existing user needs. Currently missing but required are:
    - key datasets of benefit to emergency services to consistent and high quality standards which classifications already exist in AddressBase e.g. public toilets, CCTV cameras, bus stops
    - Daily updates delivery mechanism / system
- Identify key datasets and primary sources, many of which can be managed centrally (provide full coverage and no additional demand on local authorities – e.g. road junctions, motorway marker posts ; public phone boxes ; electricity substations)
- Use the existing addressing DTF to load into command and control / key systems
- Create a subset of “sensitive” locations to be used securely by emergency services partners only which emergency services can access on top of other public sectors.

(3) Other potential valuable dataset: Full National Transport Network

- To build on the success of TfL: an integrated National transport network (road, bus, rail, etc). This would create a lot of interest nationally both for public consumption but also for identify gaps in service provision for various private companies. Specifically related to police service, it would also help with police enquiries re- missing persons, potential warrant / search for fugitive; as well as ensuring our elderly population are able to access police premises, etc.
- This would require to mandate:
    - public transport licensees to provide data to build national datasets suitable to underpin public travel apps such as Citymapper but nationally

- the creation of spatial data by private sub contractors (e.g. bus companies, any contracted bodies) and given back to Local authorities / emergency services

Q18: Are there any other areas that we should look at as a priority?

As a police service, we believe that the priority is :

- Increase the number of **web-based data provision / delivery** – as covered previously – i.e. data needs to be provided as an easy and readily consumable format (e.g. web services or APIs). For the public sector, this would minimise efforts and processing duplication across various organisations. E.g. a PSMA zoom stack – which can be cached / used offline on mobile device also. For the public sector, web-services of PSMA products should be free of charge.
- Better address \ location error \ omission reporting processes.
- Improve data sharing capabilities between public and private sector organisations.
- Influence **suppliers to adopt British geospatial standards** as well as OGC standards.
- **SNN legislation & processes** to be reviewed and updated: currently are too old, not fit for purpose and underpin the whole address creation process – e.g. only mandatory to give a number to a building if it is residential as opposed to business. Making it mandatory for all, would help with the issue of business names changing – as we could use a standard address.
- **Public Transport network** (i.e. TFL but nationwide) – as outlined in Q17 for economic return.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Within the police sector, we believe the main innovation that do rely currently on the use of accurate geospatial data is:

- The Adoption of Geofencing – dynamic alerts based on location: police forces are increasingly looking at using such technologies to alert officers on risks / current priorities and for tasking purposes.

- Augmented Reality – again looking at embedding risk markers for locations as augmented reality - this could be used to inform officers / staff of risks at a particular location they are deployed to, or other emergency services staff when attending incidents. This has been demonstrated to many police forces by Aligned Assets (gazetteer software provider) with their XDM module.
- Moving public sector to (secure) cloud to enable better collaboration – e.g. Resilience Direct – but currently Resilience Direct does not really consume live feed and require continuous static upload.

In general, and more long-term, we recognise that public transport operated by autonomous vehicles (e.g. autonomous buses) will require very accurate highways and street furniture geospatial data. However we do not believe this affects the police service at present.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We need the Geospatial Commission to become the forefront of the UK geospatial industry and increase the UK visibility internationally by:

(1) Bold statements / headlines

- Strong leadership making bold news and big decisions:
  - Establishing key geospatial data standards
  - Undertake key projects of public benefit (Emergency service gazetteer / infrastructure to support MAIT)
  - Commit to / provide funding for (public) spatial sector
  - Foreign standards (adapt and build)
  - Key attributes to monitor
  - E.g. FULL data release of base mapping – bold but brave!!!

(2) 'Geospatial Commission' as "International Centre of Geospatial Expertise"

- Create a sub-body of the 'Geospatial Commission' as an "International Centre of Geospatial Expertise/ Excellence" – creates interest as it gives the sense the body is already expert.
- Recruit best international geospatial experts.
- Capturing good practice and Return On Investment examples - promoting them at international conferences to international audiences.
- Become the defacto location to host international geospatial conferences.

- Geospatial commission comms campaign to showcase UK geospatial at high profile organisations (e.g. United Nations, World Bank – e.g. re-use of geospatial for human geography, economy).
- Increase UK involvement/ investment in geospatial emergency response charities e.g. MapAction / Team Rubicon.
- Understanding what other countries have or do not have, and find a niche that nobody has exploited yet (benchmarking ourselves).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We believe that a good place to start is:

- **USA:** the United States of America have always led geospatial policies / software & open data ideologies. There may be some lessons to learn from their Federal Geographic Data committee standardisation work…which aims at standardising geospatial data across states: https://www.fgdc.gov/standards with regards to the national strategy allowing for regional differences.
- **Canada :** Canada produces world class geospatial software (e.g. Safesoftware FME; Latitude geographics Geocortex, Geotime, etc.…)
- **China and India** are an emerging / growing market with a lot of services being outsourced to India, and new GIS software / training services developed (e.g. GIS247 in China).

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Postal Address File Advisory Board
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Do not neglect the importance of addressing.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

No response.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

None.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The Postcode Address File Advisory Board (PAB) is not strictly a geospatial body. However, the Board is charged by Ofcom with looking after the interests of the users of the Postcode Address File (PAF) dataset which, whilst strictly a listing of addresses to which postal operators and deliver mail, is used widely for other purposes such as identity confirmation, by commercial companies such as insurance providers to calculate fees, or by government to delineate catchment areas for schools and hospitals etc.

The PAB would welcome ancillary datasets to the PAF, such as the file of properties Not Yet Built or that of Multiple Residence, or the postal re-directions file being made available for data analysis. As with all datasets, however, it is essential that appropriate investment continues to be made to ensure that data are timely, relevant and accurate.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

What is an address? The answer will vary according to user requirements. Postal operators want to know where they can deliver mail – and this was the origin of the Postal Address File. Emergency services need a wider definition which will include, for example, parks and recreation spaces. Others may have different requirements. Whatever they are, however, the prime requirement is that a dataset should be relevant, current, comprehensive and accurate. Our experience of comments on the PAF is that, within reason, pricing is not as much of an issue as ensuring PAF accuracy. This perhaps argues for a comprehensive address file which could be interrogated according to the various user requirements.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No response

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No response

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data might be restricted to addresses that do not move. However, recent developments in order fulfilment suggest that a wider remit, to include the location of assets that are mobile, but at any one time can be related to geospatial data, could be important.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Organisations in the public sector currently benefit from a central Public Sector Licence (PSL) for PAF which enables them to use the file without direct payment. The PAB would support the extension of centrally purchased licenses for groups of users that would replicate the arrangements for the public sector licence. In principle this could include the government purchasing an all-embracing licence for any UK registered body, though given the importance of data quality (see Q5) it would be necessary to create safeguards so that political exigencies did not adversely affect the funding of a high-quality dataset.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The PAB would suggest that geospatial data should be regarded as 3 dimensional rather than the traditional two-dimensional views (i.e. should cover matters above and below ground level).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

PAB experience with the Postal Address File has been that private sector solutions providers have been imaginative in linking postal delivery addresses to other datasets and incorporating the results into software solutions. This suggests that granting access to public sector geospatial data on relatively low-cost terms would be a good way forward. We do not advocate free access to the data as we fear that the absence of income would inevitably lead to a reduction in quality assurance by the data managers; and we would wish to see big entities that are multi-data enterprises pay an appropriate fee for geospatial data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

No response

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No response

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No response

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No response

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No response

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

There is an obvious link between the property and land category of geospatial data and enhancing the Postal Address Fikle.

Q18: Are there any other areas that we should look at as a priority?

No response

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No response

Q20: How best can we make the UK's presence in the international geospatial world more visible?

No response

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No response

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Publica (Forest of Dean, Cotswolds, Cheltenham and West Oxfordshire Councils)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**x**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It is an accurate description of Geospatial data and encompasses all data types, but could it include examples in each case to help expand on the description?

Should 'Geospatial services' be Included in a 'data' definition?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Street Naming & Numbering – Legal guidance, best practice
Address data – promotion of the dataset
Local Authority derived data

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- GIS Officer roles being reduced – we need better awareness of importance of role and Geospatial data within Local authority
- Role of LLPG Custodian so intergral but often under estimated and under resourced. A Statutory function responsibility should surely receive an increased pay scale
- More links with local schools colleges and Universities. Represenation at carreers events. Work experience opportunities for Geography and IT students

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Terrier/ Land and Property Information is held in a variety of formats and often incomplete. Historic deeds not electronically captured and ownership boundaries not digitised.
- Land Registry data for Private ownership – Would be a useful layer but obviously restricted as there is a cost per search
- Utilities – Gas pipe lines, Overhead cables, water, drainage – Would like to see better coverage in a downloadble/useable format
- Business Rates data - not easy to match with Local Land and Property Data due to poor locational information (lack of commercial unit layout plans)

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- Real world accuracy of address data and street data needs to improve with the introduction of technologied like autonomous driverless vehicles. ie. not just satisfying the Geoplace quality checks
- Better SNN guidance and consistent processes to simplify and speed up processes and get change data outthere more quickly
- Street furniture asset recording to provide a database of physical locations in Urban environments to better support WiFi networks/internet of Things/Smarter cities
- We could strive to make the recording of Land parcels more precise. eg What3Words. How can the UPRN be used in conjunction with these technologies?

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Improved accuracy of address data locations and UPRN currency
- Better coverage to a higher degree of precision (as above)

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- More guidance nationally for SN&N
- Consistent National guidelines for Local government Geospatial data collection with regards to acceptable formats, schema and metadata.
- National central repository/database for Local Government data sets eg. TPO, Conservation, Green spaces, Local Plan Policies, SHLAA, Terrier data eg. As we have done with national Brownfield register

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Increase precision and accuracy of GPS which needs to be supported by improved 4/5G networks and wifi networks in Urban areas to further enable geospatial data on mobile devices

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- Share end user experiences and best practice Case studies.
- Improvement of Mobile Data networks/WiFi networks
- Construction Industry – more communication on completions and commercial unit layouts
- Improved Promotion of latest Geospatial system technologies to public sector

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Continued Promotion of the UPRN, NLPG to enforce adoption across Public sector
- Consistent National guidelines for Local government Geospatial data collection with regards to acceptable formats, schema and metadata.
- National central repository/database for Local Government data sets eg. TPO, Conservation, Green spaces, Local Plan Policies, SHLAA, Terrier data eg Brownfield register

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- Set specifications for quality, accuracy, currency of data – how it should be delivered etc.
- Quality standard goal setting/milestones
- Could we introduce financial penalties or incentives for local government geospatial data provider to help achieve targets/standards
- Promote the importance of the role of LLPG/GIS/Spatial professionals within local government

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Mastermap WMS feed
- Other spatial reference systems eg What3words
- Emergency Services data
- Utilities data

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Challenge Local authorities to work together on local and regional Geospatial strategies that should follow the same format as a UK strategy and carry consistent themes.

Encourage regions to identify local variations in their geospatial data and highlight what their regional themes and data challenges are.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Direct and effective communication with Local governments – not just GIS/LLPG contacts but CEOs and senior management teams – especially those who are responsible for collection of Key geospatial data sets.

Regular, regional engagement meetings involving GIS professionals AND other Key stakeholders from Local authorities.

Use financial incentives/penalities to encourage better practices around geospatial data collection

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

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About you and your organisation

Name	[Text redacted]
Organisation	Registers of Scotland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It's broadly accurate. Inclusion of a temporal dimension might be beneficial: spatio-temporal change is of relevance to a broad audience.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial data handling and stewardship skills need considerable investment to fully harness the potential benefits of the data assets we possess and are creating.

Capability and capacity in relation to both technical and business-oriented skills needs to be expanded.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

See above. Spatial data skills should not be developed in silos but integrated into wider business operations.

RoS is building spatial-data analytical capability, internally and within the wider Scottish analytical community, through participation in initiatives such as sponsorship of MSc students, the new Scottish Data Science Accelerator programme, and other opportunities arising through programmes such as the Scottish-Government-led Scottish Public Sector Analytical Collaboration (SPACe) – e.g., to enable greater interchange across collaborating public sector organisations. New graduate recruits to RoS are supported with good technical training and opportunities to engage with projects within the wider business being developed as part of RoS' on-going business transformation programme. RoS has a strong outwards-focus ethos and actively seeks collaboration with our stakeholders to develop partnership working, e.g., through participation in the Scottish Government-led geospatial stakeholder group. Opportunities for geospatial work at RoS are also promoted through national events such as The Datalab's annual Data Talent day

for students.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Spatial data on ownership (and other rights): RoS is not a surveying organisation and collecting spatial data is not within our public task, hence the critical reliance by us on work by OS. We would welcome improvement to feature attribution and lifecycle information as we are required to ensure land register titles are maintained on the most current version of the base map. This specifically relates to distinguishing the difference between topographic mapping and ownership/occupation of land.

Quality is clearly important, but at an appropriate level of granularity for the work we need to do; too much information via MasterMap updates is as much a problem as too little. We are keen to achieve improved partnership and alignment of workflows across OS and ourselves to harness the available data to level best value.

Currently, the frequency of MasterMap updates doesn't align well with our business requirements, with variable frequencies for different components. A consistent approach to surveying across Scotland would be very helpful – particularly, for example, for new housing estates (whether in urban or rural areas), with consistently timely updates.

Critically though, RoS wishes to avoid any degradation of current standards and updates frequencies. Maintaining resourcing for MasterMap updating is essential to us given our dependence upon this for our Public Task.

Improved availability, quality and interoperability of data that is being made available by the public sector would be beneficial. Scotland's Land Information Service, ScotLIS, provides a unique opportunity to provide information based upon geospatial data in one place, meeting the needs of people involved in transacting land and property (and members of the public). Efforts to date looking at the inclusion of data from local authorities has proved challenging due to the reasons mentioned (namely quality).

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

RoS notes issues in relation to:

- The address data life-cycle
- Consistency, given variable practices across local authorities.
- A single (rather than multiple) sources of addressing truth would bring value
- Clarity over licensing for re-use

Whilst different organisations have had different purposes for addressing (e.g., for deliveries, for local service provision), there would be considerable benefit for a single

address database.

Whilst Address Base Premium (ABP) describes itself as the canonical addressing system for the UK, it has issues and is not fit-for-purpose for all applications. ABP reflects the concept of address used by the content contributors (Royal Mail and Local Councils, with postal delivery or identifying geographical assets underlying the model). Hence, while ABP represents the superset of addresses used by the Royal Mail and Local Councils it does not represent the set of all addresses used in the UK. Addresses that fall outside the *operational use* of the Royal Mail and Local Councils do not appear in ABP.

For RoS, addressing for flatted properties presents considerable challenges, given different approaches which then need to be tied into a single approach for surfacing data to citizens and to businesses via platforms such as our Scotlis land and property data portal (see www.scotlis.ros.gov.uk).

Furthermore, the *lifecycle* of an address becomes critical, particularly for those businesses that deal with properties before they are allocated a formal address (land registers, builders, utilities and banks). Organisations such as RoS have better change intelligence at these areas.

Key to the future will be referencing geo-locations (with which addresses simply coincide), and it would be worth re-visiting ISO B7666. Each address in ABP is associated with a Unique Property Reference Number (UPRN). A UPRN can be used as a core reference geography to support address attribute interoperability within and between organisations. RoS would like to explore options such as minting by us of UPRNs as geo-location identifiers. It is not possible to predict the UPRN for a new address. Without the ability to create (mint) UPRNs those affected businesses have a data management issue.

Other issues are around

- Service Level Agreements in relation to update frequencies.
- Future proofing: how will UK addresses respond to challenges around, e.g., 3D, Room based addressing, Arbitrary addressing and drone delivery? (How much longer will the use of streets and buildings for addresses remain relevant?)

ABP is likely to be the dominant formal addressing system in the UK in the short-term but might become heavily disrupted. Issues with formal addresses (national in scope, not predictable and relative to underlying street/building infrastructure) have resulted in the development of a number of informal addressing systems that challenge traditional addressing. There are a number of challenges associated with such global frameworks - the key issues revolve around arbitrary area representations, elevation and licence constraints. However, there is the potential that algorithmic address systems will become the dominant addressing system during this century.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

RoS is interested in how developments here can support its operational activities, e.g., for validating ownership boundaries.

Some points to note include:

- Time series data would also potentially add value.
- Release should be under clear licencing frameworks that facilitate reuse.
- Land-use dictionaries and mappings would need to be maintained.
- Workflow processing engines should be developed
- Spectral libraries would be required.
- Automated change detection at a variety of granularities (e.g., urban/rural)

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

RoS has no wish to predefine technologies. Our focus is on developing and harnessing our data to maximise public value, and we maintain a technologically-neutral stance in order to best support and stimulate innovation.

However, some elements of the infrastructure would be supportive to support data-driven economic activity and growth:

- *Licence management technology* (licence calculus). It is inevitable that new products and services will conflate multiple data. The data sets may run into the thousands. These data will be released under different licence conditions that will affect how downstream products can be created, exploited and licensed. Currently the management of such processes is not transparent. This makes it difficult for licence holders to levy appropriate re-use fees and to ensure that product derivatives are being used in ways that comply to all the licence constraints demanded by the upstream data files (for example a product put out for sale may incorporate aspects of a data-set with a 'non-commercial' licence clause). Such an application will facilitate pass-through data charging to licence holders and increase credibility and provenance of re-useable data.
- Further research into and exploitation of *3D topological techniques* (moving beyond BIM) should be encouraged. This would allow the improved representation of geological stratigraphy, near surface infrastructure (pipes, cables etc.) and facilitate improved thermal modelling at a local and regional scale. From a conceptual level it would build a bridge between 2D and 3D concepts (such as an address UPRN and a valuation office hereditament: there is clearly a close conceptual relationship between the two – but this breaks down in terms of the data models).

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

See above.

Geovation could unlock the potential for future technologies through supported access to Geospatial data and incubation of innovative start-ups working in known or unknown future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Business models need to enable opportunities for down-stream users to gain value from the data, while also supporting the sustainable and and up-to-date development of the geospatial assets that they hold. High quality, accessible data requires resourcing for investment and management to enable re-use.

RoS operates as a trading fund and so is entirely self-funded, reliant on the income from fees charged to meet the costs of the services it provides.

Whilst individual organisations such as RoS have a strong desire to innovate, clearly there are linkages to be managed between organisations through data consumption chains (e.g., for us, in respect of some of the data workflows we share with the Ordnance Survey and Map Base Maintenance). Strong coordination (e.g., across local authorities, to ensure consistent approaches) and partnership working will be essential to ensure concerted efforts to develop and invest and so lever genuine economic and social value.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Data provenance is essential for any data source to have value. Metadata that reflects such provenance would greatly enhance the fitness-for-purpose of any re-use process.

The data collection and support frameworks mentioned above are all critical. In addition there are the data exposure and re-use frameworks. Improved access to co-ordinated repositories which can expose metadata (to facilitate discovery and re-use) and data streams (to facilitate realtime chaining). Co-ordinated repositories will also allow increased access to ‘restricted’ data during emergency response scenarios.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

RoS is agnostic with regard to the balance between public and private sectors, if appropriate management frameworks are in place to safeguard against risks of reduced data quality and accessibility (e.g., in relation to licensing, to mitigate risks around inhibitions to re-use).

Partnership approaches, properly established on a clear footing, have merit, to lever the benefits each sector can bring, in relation to expertise, capacity and agility as well as governance and regulatory assurance. A significant challenge lies in upskilling the public sector, and clearly there are considerable synergies to lever.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges relate to:

- Standards to improve consumption / interoperability
- Formats – from non-proprietary re-useable formats (csv etc.) to self documenting formats (xml, json, rdf)
- Vocabularies (internal, domain agreed and persistent)
- Licensing, which is essential to facilitating unambiguous re-use

These aspects of spatial data are all essential to resolve, and technically-feasible solutions could be found. However, the will to find and coordinate cross-organisational capacity is the fundamental challenge.
Challenges relating to making available data within ScotLIS are consistent within question four. Quality and update frequencies are issues, including the level at which some of the data is mapped at. We would benefit from investment within some local authority data sets to improve their viability for inclusion with the land information service.

Where data is made available within new initiatives e.g. digital planning, it should be interoperable and available to others for inclusion.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission could play a useful role in relation to championing licensing developments to facilitate unambiguous re-use of data.

Like many government organisations, RoS is examining ways in which the data and services it manages can have greater societal impact beyond the core legal conveyancing remit through open and commercial service streams. Some of this is a response to the transparency agendas promoted by national governments (open data) and the European Union (INSPIRE) designed to increase stakeholder access to national data and to catalyse the 'knowledge economy'. This means the derivation of new data products and services. Some of these products and services could be accessed under commercial licences which would provide alternative income streams.

Licences will be produced on a product by product basis and, wherever possible, are likely to be based on standard licences (i.e., Government or Creative Commons licences). Clearly, when any of these data products re-use content provided by the OS then any downstream product and licence must be compliant with any upstream licence. In this regard the current OS licence poses challenges.

Protection through licensing conditions by OS of the intellectual property inherent in its data is appropriate given the quality and investment in the products. However, the suite of licensing models is complex, making it difficult to determine what can and cannot be done with any resultant derived or conflated data product. The spatial description of rights in the Land Registry system is heavily reliant on OS IP; hence, the terms associated with OS licences are crucial to RoS data derivations. Full clarity is needed surrounding rights to re-use data, maximise impact and commercialise data products.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As noted above, data provenance is key to harnessing value through re-use.

Planning data is of considerable interest across the economy. Digital planning is highly symbiotic with RoS public task work (e.g., with regard to change intelligence for workflow etc) and partnership working around this could create significant public benefit.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Consistency across local authorities is a key issue.

In Scotland, Digital Office activity is supporting this aspiration. In Scotland, the Local Authority Digital Office activity is one channel supporting this aspiration. Through potential collaboration with OS on Geovation effective Local Authority collaboration could be achieved.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

In October 2017, RoS launched ScotLIS our land and property information servicel, in public beta. As well as surfacing our registration data, this evolving platform will provide considerable potential for a range of other applications to add social and economic value.

RoS launched Scotland's Land Information Service (ScotLIS) into public beta. It provides a wealth of information on land and its ownership, with plans to improve on this over time. Its aspiration is to add 3rd party data where it augments data already available, and provides value to users.

With the correct investment in 3rd party data to improve its quality, it would be possible to include this at a larger scale and ensure there is trust in its accuracy – one of the bigger blockers to progression at the moment. It would result in property searches being more informed, and easier to conduct.

It is also possible to combine both 1st and 3rd party land and property information with digital planning, and other possible sources – for example; allowing users to understand whether planning applications have been submitted a given property and who owns it.

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The ScotLIS Roadmap is available online for all to see, and the public service can be accessed via https://scotlis.ros.gov.uk/.

Q17: Are there any other areas that we should look at as a priority?

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Clearly, in an ever more interlinked globalised world, engagement with international interests will be key, e.g., to ensure appropriate standards are chosen for frameworks.

RoS is an active participant in a range of international fora, including the Registrars of Title Conference, the Federation Internationale Geographique (FIG) and Eurographics.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

RoS has found useful frameworks and comparators in Land Administration via ISO standards such as LADM ISO 19152. RoS has also drawn thinking from the New Zealand and Dutch cadastres as well as from Norway, Sweden and Estonia.

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Name [Text redacted]

Organisation Reigate & Banstead Borough Council

Job title [Text redacted]

Address [Text redacted]

E-mail [Text redacted]

Telephone [Text redacted]

Please select which of the following best describes you as a respondent:

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Individual

Legal representative

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Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. Supporting innovation in the geospatial sector, exploring how to secure

cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself

2. Enhancing the UK's geospatial assets, looking at how best to align

interests, avoid duplication, and instill best practice across the whole public sector

3. Driving investment and productivity in geospatial applications, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No comment.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

a. Data Science / Big Data

The growing availability of real-time sensor (IoT) data and its potential to reveal valuable insights means that GI professionals also need to develop their skills handling Big Data, e.g. Data Science skills. It is very uncommon for GI professionals currently to be familiar with and using big data technologies. Whereas other Data Science industries (e.g. data analytics) are moving towards GI and pragmatically solving challenges in new ways, potentially making applied GI work increasingly obsolete. Missing this opportunity may mean that the scope of geospatial is more limited to niche analytics of refined, structured data, rather than the discipline getting involved closer to data creation. These other industries and disciplines are developing faster than GI, e.g. Business Intelligence (BI)/Data Analytics (DA). GI professionals are used to structured data warehouses and Extract, Transform, Load (ETL) workflows, but these don't scale well to Big Data volumes, velocity and variety. Developing skills in noSQL, search technologies, batch and stream processing, etc will bring GIS closer to the forefront, rather than becoming a niche discipline for specialist work.

b. Convergence

There is a need for GI professionals to develop their skills in Data Analytics and Business Intelligence. These industries are much larger, evolving more rapidly and building geospatial capabilities themselves. Typical GI skills in data manipulation and cartography transfer well into DA/BI, including designing visualisations (beyond just maps). Typical data-driven managers (in areas I'm familiar with) increasingly want simple, fast visualisation of data, not complex, in-depth analysis. For example hotspot/heatmaps – latest generation BI tools (e.g. Tableau) make this a single button transformation, not a detailed scientific decision to assess the best interpolation algorithm. GI needs to move towards BI/DA, sharing knowledge and building common skills. Knowledge share will also lower the barrier to entry into GI for those that wish to specialise in the geography. c. Links with Academia

GI professionals, particularly working in government could benefit from professional development in collaboration with academia. For example, Surrey County Council worked with Surrey University Business School to build digital transformation skills and familiarity with emerging technologies. Massively Open Online Courses (MOOC) are commonplace now and cover necessary topics. Discounted enrolment could be offered to public sector analysts.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

a. Information Governance Confidence

GI professionals have potential to be the gateway between a wealth of valuable data sources (many of which they've got domain knowledge on and have imported into spatial data warehouses). Uncertainty around the law, policies and ethics of data sharing, processing, aggregation, analysis can discourage use of some data, stifling value generation. Solution: Work with professional bodies in the IG space to offer incentivised training opportunities for GI staff, particularly those in government roles. Formation of local support networks for GI professionals to ask questions of IG specialists (i.e. former Centre Excellence Info Sharing). Sharing best practise, including identification of typical safe gateways with which to process certain data (e.g. mobile phone activity data, vehicle movements, open data publications, etc). b. Data Science

Councils have significant opportunity to improve services and outcomes by better exploiting their data and emerging technologies, including less traditional data sources (e.g. real-time IoT sensor data, drone survey data, telemetry - route optimisation for ambulances, bin lorries, gritters, Special Educational Needs (SEN) journeys...). Currently local government (including us) do not widely possess the skills to exploit this

data and either suffers or pays consultants. We are also not factoring these technological and societal changes into our forward plans and service strategies, due to an unfamiliarity of the potential. GI professionals are well placed however to seize this opportunity, through focussed professional development. Recent ‘Buses Bill’ just one example –local government isn’t ready to exploit this new data and improve public transport / ease congestion. Solution: Work with academia to design short, flexible, [MOOC] courses to develop data science skills. Encourage tailored courses at discounted rates via AGI accreditation. Centre of excellence and secondment opportunities to encourage knowledge sharing and foster networked behaviours. Promote careers to students via academia links. GI needs to be more visionary, encouraging us all to embrace newer technologies. c. Data Analytics / Business Intelligence

We need to visualise data in many other ways, not just the geographical dimension. This would be done with BI/DA tooling, in what is a rapidly growing and maturing market. Solution: Open up GI knowledge to other areas – those in BI/DA struggle to embrace complex address data schemas, projected spatial data, for example. Promote GI careers also, to those that want to specialise. d. Free, Open Source, Community Mappers

Supporting the voluntary work of community mappers is valuable and could encourage more to enter the industry. Extra support to local authorities in address change intelligence would be valuable. Solution: OSM Mapper in Residence scheme

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

a. Address lookup web service

GI professionals waste time finding, downloading, transforming and maintaining duplicate address and other core reference datasets. We want quick, reliable, cloud-hosted web services of these core things to use on a commodity basis within digital services and back office systems. The Surrey GIS Forum pioneered this some years ago with their AddressBase API, developed from a GDS origin. This is available freely to any PSMA clients, and currently used in tens of local authorities. Chargeable alternatives include OS Places. Solution: Include OS Places or equivalent address web service within PSMA. b. Planning data

For councils and society at large it is hard to find planning information. This varies across boundaries and organisations, in terms of responsibility, format, accessibility, local conventions/interpretation and is quite frankly out of touch with modern society’s needs (e.g. notices on lampposts!). Significant efficiency gains internally and externally from better data curation and sharing. Solution: The Surrey GIS Forum have done discovery and prototyping work as well as lobbying (survey results available on

request). Including building a prototype Planning Hub using BIS Data Strategy ‘breakthrough funding’. LGA launched Incentive Scheme followed. Current blockers for full commercial use of this data due to OS derived data rights. Consumers such as Land App and Land Insight. Regional/national scale-up. c. OS large scale basemap cloud service

Core reference data that gets locally downloaded, processed and managed unnecessarily hundreds of times in duplicate, when most simply need the latest data running in their web and back-office systems. Many of us pay for cloud tile services, which could be improved upon via centralised procurement. Solution: Access to hosted data included in PSMA. d. Land Registry title details

Full textural attribute data for Land Registry titles would save time and improve quality of local decisions. Currently we need to pay to reveal full detail, despite title parcel geometries being available under INSPIRE. Solution: Access to data included in PSMA. Potentially reconsider as part of any Land Charges and Land Registry re-design.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

a. Pace of address data maintenance

Increasing pace of digital transactions and public expectations for immediate service delivery (alongside any open data release of NLPG) will require LLPG Custodians and Street Naming officers to work in a more coordinated and timely fashion, as well as central validation/refinement to be faster (e.g. addressbase 6 week cycle). Solution: Central maintenance of BS7666 LLPG data! Deeper integration between main address databases / organisations, including at a local level, where Planning, Council Tax, Elections, Refuse and other services can be vital indicators of address intelligence for LLPG custodians. Use of additional data sources (inc commercial) to help maintain LLPGs – especially anything to improve commercial address quality. b. UPRNs made open

Releasing the [postal] address textural string may be insurmountable, but releasing the UPRN will still allow better machine to machine exchange of address data, realising efficiencies. Solution: Release of UPRNs and spatial coordinates as open data.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

No comment

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

a. Emerging technologies

See Gartner Hype Cycle, including 2018 version. Virtual, mixed and augmented reality all have significant reliance on geospatial data, as do many other pre-consumerised technologies shown. Many of these technologies will mature in the time period of the average council's corporate plan, yet are not considered deeply enough (despite representing significant disruptive forces). Obvious priority areas would be mixed reality, autonomous vehicles, drones, IoT platforms and 5G. With a growing amount of instruments and sensors within personal transport, government should be considering the data infrastructures necessary to exploit this. For example – crowd-sourced road condition surveys, real-time route optimisation, etc. Solution: Involvement with academia, government-funded research labs and leading commercial organisations to explore opportunities to incorporate more geospatial data into emerging technologies. Discovery and prototyping. Centre of excellence / collaboration in existing (e.g. electric vehicles – transport research laboratory). b. Current [underexploited] technologies

Some current technologies have potential to benefit from increased use of geospatial data, including voice control/assistance / augmented reality, drones. Voice is mature in consumer artificial intelligence offerings like Siri, Alexa, Cortana, but geospatial data is not available or presented well enough for full exploitation. Obvious examples would be for integrations to be deployed to facilitate access to public services, dependent on location and personal circumstances. Solution: Data needs to be refined, published and integrated, ideally in a coordinated way across the sector. See Google dataset search for example of how public data can be surfaced and integrated into services like google (thus Assistant). GI needs to converge around popular technologies at least to demonstrate potential.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

a. Data infrastructure (visionary)

A robust data infrastructure hosting core reference data and brokering the exchange of data across and between sectors. Getting involved in this now to prevent being left behind by technological pace of development and potential commercialisation / vendor locks. Example include smart vehicles - supported by data standards and aligned with vehicle tax and other databases and income streams. Vehicle sensor data collection – could all vehicles deliver data about road condition to a central repository, regardless of vehicle manufacturer, specification and age. This will be made possible with 5G and increasing IoT sensor technologies. Solution: Engage with technology disruptors and

leaders, academia and others to shape thoughts and design prototypes. b. Data infrastructure

Central repository of core reference data and web services to ease access to

reliable, authoritative geospatial data, primarily within the public sector. Remove duplicated processes of obtaining, transforming, loading and hosting data. Solution: Establish central data repository, web services, etc. Work with Open Data Institute (ODI) to build 'open' best practise into solution.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

a. Crowd-source

Local-level partnerships with Open Street Map (OSM) community to input change intelligence information into local authorities. E.g. OSM Mapper in Residence scheme. Better coordination between volunteers, local authority and Ordnance Survey to capture address and topographical changes and share without friction. Likewise, open data may offer an element of third-party inspection and correction of data, where many eyes and alternative uses can reveal errors. Finally, open data can foster new tools and applications for use within the public sector, such as Spend Network, who worked with Surrey County Council to hone open data publications in exchange for sharing knowledge on visualisation best practise, with resultant improvements to internal data analysis. b. Open Source

Contribute to development of free, open source GIS software (e.g. qGIS), making it an increasingly viable alternative to proprietary vendors. Cashable savings and development of common skills base and support network. c. Central data infrastructure

Reap local-level efficiency savings by offering core reference data from a central source, avoiding huge duplication effort among GI data administrators. d. Central address maintenance

Whilst a much-debated and explored topic, this is one that could yield local savings and facilitate a more punctual and less resource-intensive compilation of the national address gazetteer. Presumably plenty of costs and concerns elsewhere with this proposal however.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

a. Standards

INSPIRE, BS7666, OGC, Gemini, XML, ESD (LGA). Encourage use of standards, to ensure they reap value. Especially those applicable to the public sector where this could reduce data exchange friction. Local Government Association ESD standards list is a comprehensive and powerful list of services, functions, powers, duties and more. Complete with linked data Unique Resource Identifiers (URI), this can allow datasets to be collected and combined for greater insight.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

a. Data marketplace

We should seek to create a data market / information economy whereby all sectors can contribute and consume. A valued underpinning digital infrastructure that is of value will need maintaining mutually. Whilst dated, the London City Data Strategy approached this in their 2016 document, focussing on the wider data spectrum, not just open data. Role for academia also, who also would want access to processed, administrative data for research purposes. Local/regional pilots, akin to ODI Node model. b. Standards

Co-author, use and maintain cross-sector open standards.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

a. Fragmentation

In local government there is considerable variation in the way data of the same topic is produced, stored and shared (if at all). An example of this is planning application data which despite being fundamentally the same and delivering the same function, can differ considerably across administrative boundaries. Solution: Work like the Surrey Planning Hub to harmonise publication of planning data and make collective, value-added information available from a central web service, for any downstream use. Work in an open source environment to share knowledge and encourage widespread collaboration. Embrace common standards, such as those created by the LGA, iStandUK and others. Encourage and nurture coalition innovation groups like Surrey Digital Services, perhaps with more formal support like the Geovation model. b. Discovery & access

Other than local data observatories and open data syndicated onto data.gov.uk, there is no central portal/inventory where public sector organisations can share definitive data for others to access. Whether this is

snapshot data for download, or access to live web services. Solution: Encourage further publication of data onto data.gov.uk (DGUk), including OGC web services (WMS/WFS). For licensed or more sensitive data consider enhancing DGUk to host these datasets for authorised users (perhaps similar to http://environment.data.gov.uk/ds/catalogue/#/catalogue). Pursue INSPIRE-type roadmap of discovery, view and download services, as well as data schema harmonisation. Develop data inventory concept used in linked data principles and by some open data publishers. A firm enough, sustained push, alongside provision of tooling / central hosting will see local government conform. Ongoing compliance linked with PSMA licensing and/or improvement schedule approach. c. Data sharing agreements

Local government GIS officers can lose time preparing bespoke data sharing agreements for regularly requested data. Equally, end users/requesters don't want to be concerned by government boundaries or varying licences. Solution: Standardise popular data sharing agreements, like the PSMA does. Create a tool to allow pick-list based customisation of standard agreements, building the legal text behind the scenes based on user selections. Align with data sharing services like Emapsite's Contractor Portal, such that data access can then be granted, without burden of extracting, packaging and distributing data.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No comment.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

a. Aerial imagery

More frequent surveys of visible light imagery, LIDAR and potentially oblique imagery. Uses for tens of local services, including planning, enforcement, countryside management and more. b. mData (aspirational)

Aspirationally speaking, it would be good to access mobile phone activity data, for a whole raft of reasons to support our service planning and delivery. Raw data is well into the Big Data definition however, so skills are not yet mature enough in our sector to analyse the data ourselves, hence access would be more a case of consuming off-the-shelf insight reports, perhaps about migratory patterns into major towns, etc. Experimental, discovery work.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No comment.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

a. Industry groups/bodies

Industry groups like the LGA and AGI have been useful in encouraging change and compliance across local gov, for example with open data (incentive scheme, transparency code) and INSPIRE initiatives. LGA incentive scheme successfully created hundreds of open data publications from local government, essentially overcoming many of the initial steps with sharing data effectively. Online KnowledgeHub remains a useful networking and peer- support tool. b. Local area peer groups & liaisons

To convene regional meetings and bring together those working in the same field. Including those specifically looking to drive transformation – e.g. Surrey Digital Services. Potentially widen scope of meetings into something resembling the ODI Node structure, allowing greater sharing of skills and knowledge. Accommodate and encourage academia. Forum for officers to share experiences and avoid common pitfalls. Incentivise collaborative work to conduct work over multiple authorities rather than singularly at greater overall expense – e.g. waste round route-optimisation. Support LocalGovDigital, including LocalGovCamp. c. Alignment

In terms of helping compliance with any newly proposed initiatives, alignment with existing regulation/directive tasks like INSPIRE, BS7666, Census may help as most authorities are committed to these. d. Common tools

Greater coordination can be encouraged by providing consistency in the way things are done – i.e. central address maintenance, web services, open data publication, metadata, etc.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

a. Planning Hub

The Surrey GIS Forum's prototype planning data aggregator was hindered by OS derived data rights, preventing release under OGL and thus consumption by the land and property industry. LGA evaluation report. Astun Technology case study. iStandUK 2016 award. Developing this further in an environment without such restraints, adding spatial extents, more attribute data, improved address/location details (e.g. UPRN) would significantly increase downstream benefits. Other authorities have pursued this, including Hampshire and Hackney. Opportunities to align interests of public and private, for example, planners, land charges, contaminated land, surveyors, land owners, builders, etc. As startups Land App and Land Insight are proving. b. SDS AddressBase API

The Surrey GIS Forum created a nationwide OS AddressBase Premium lookup accessible by any PSMA customer. This satisfies a widespread need among councils for simple, fast address lookups in their web applications. Applications of this nature could be scaled up, at least within the public sector / PSMA community.

Q18: Are there any other areas that we should look at as a priority?

No comment.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

a. Next gen personal transport

Growth of electric cars is necessitating more intelligent journey planning to factor in necessary and convenient stops (tailored to driver's preferences). Accurate and real-time geo data required, for example on congestion, charger availability, nearby services, etc. Autonomous cars clearly a whole level deeper in terms of geo data required. b. Oyster-style public transport outside London

Buses Bill facilitates sharing of commissioned transport provider telemetry data which will require a [geo]data infrastructure to gather, consume and publish for innovations like CityMapper to florish. Significant citizen benefits and potential government commissioning improvements. c. Google dataset search

Not strictly an innovation in its own right but surfacing well curated datasets through google and thus allowing their integration with machine-based

processes will facilitate a lot of potential innovations. d. Dynamic location service delivery

e.g. Delivery of parcels to individuals based on their current / forecast location, relying on a more granular location/address framework. Probably reliant on machine interpretation of 'address'/location data, not traditional address string. (whatthreewords, UPRN+X/Y coordinates). Like Volvo's connected cars development. e. Centralised Land Charges service

Basic data housekeeping and sharing between central and local government. Opportunity to conduct discovery work / observe challenges.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

a. Open source (FOSS4G, OSM)

Support open source software and mapping. Invest in the development of common tools for anyone to use.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comment.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Royal Botanic Gardens Kew
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	x
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

A level of education about the value and use of Geospatial data needs to be added to one of these themes.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We work on the imaging and research side of the industry and there is no shortage of interest and suitable candidates for our posititions, but unfortunately we can not offer commercial salaries.

Graduates other than PhD students seem to lack the experience that we need, and we have instead started to offer internships for small research areas.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

High resolution satellite imagery is always of benefit to our work, but comes at a steep price. WV2 is our most purchased resource, but few projects can afford the data.

We now use drone data a lot more, but there are no Civil Service resources for Geospatial training or drone pilot course of which I am aware, and commercially they are prohibitively expensive.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Providing greater free access to high resolution datasets.
Sharing of free data that has UAV collected, or processed.
Sharing expertise in newer innovations.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Access to drone share imagery or products

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

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Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Quantitative Methods Research Group (QMRG) of the Royal Geographical Society with the Institute of British Geographers (RGS-IBG)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	

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Other - please state	

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Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The Quantitative Methods Research Group (QMRG) was founded in the 1960s as a branch of the RGS-IBG, with the aim of furthering research and education in all aspects of quantitative and computer methods in Geography. This aim still stands, albeit now focussed increasingly on research and education in the geospatial data analysis and geographic data science. The current QMRG committee consists of academics (who are also RGS-IBG fellows) elected from an array of British universities, including instutions having a long-standing reputation nationally and internationally for quantitative geography and geographic data science. Currently there are around 200 member of the QMRG across all career levels from postgraduate level upwards, and the Committee has sought input from QMRG members to inform this response. Given the aforementioned focus of the QMRG at the education/research axis, plus the time available to the Committee to make this response, the focus of this response is limited to only the first theme on 'supporting innovation', and specifically to Questions 2 and 3 in the Questionnaire. However opportunities to engage in other themes/questions would be welcomed by the QMRG Committee.

Question 2 in the Consultation regards steps that could be taken now in order to ensure that geospatial skills are developed into the future. For the QMRG Committee this is fundamentally a question about teaching and learning, and linking up to opportunities to develop interests in geospatial knowledge and skills across all educational levels. Specifically, and reflecting the QMRG's position as part of the RGS-IBG, we see huge value in promoting these opportunities through the subject of Geography, not just at university level, but also at pre-University and postgraduate levels. Geography as a study of people, places and our planet should be an exciting subject for learners, and we have observed through our own teaching practices the ways in which education in Geography can ignite interest in more advanced and complex forms of geospatial analysis. In our view Geography is better placed to kindle such interest than courses which have a heavier mathematical or computational focus. However, while we can point to some cutting edge courses and practice that fulfil these demands and expectations, among our own and other institutions, we are also increasingly concerned about recent changes to Geography's position in the British education systems. Although the numbers of students entered to A-level Geography increased slightly over the past five years, last year saw a decrease in entries, in part associated with the 'de-coupling' of the Geography A level from the AS-level in England, with Geography slipping to become the 10th most studied A-level, entries being down by 8% compared to the previous year. In other parts of the UK the situation is even more challenging, as in Wales and Northern Ireland there have been year on year decreases in the number of students entered to A-level Geography since 2015 (see https://results.ffteducationdatalab.org.uk/a-level/geography.php), while in Scotland the Royal Scottish Geographical Society has expressed concerns that the move to the Scottish 'Curriculum for Excellence' (among other factors) is leading to a narrowing of school curricula, in turn posing a threat to the numbers of Scottish-system pupils choosing to do Geography. Overall this picture raises concerns about a potentially diminishing status and profile of Geography in our education systems, and our concern from this is the reduced numbers who may consider Geography at university or postgraduate levels. If we see such reductions occurring, then in turn this may also impact on the upskilling new

generations of learners able to spearhead and advance the geospatial revolution. We would therefore advise the Commission to pay heed to the aforementioned changes and to consider ways to mitigate their potential negative impacts. The RGS-IBG has done further assessment in this area, including recommendations to the A-level Content Advisory Board in 2014 regarding greater integration of quantitative methods into the A-level curriculum, and more recently its 'Data Skills in Geography project'.

Secondly and on a more specific point, we were uncertain about what is being referred to by 'current government policy' in the associated section in the Call for Evidence document (page 13). While the section constain an outline of a few useful ways in which geospatial skills acquistition may be promoted and enhanced, these are suggestive only, and as such could not rightfully be labelled as 'policy'. It would be helpful therefore if this reference to policy could be clarified.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As noted above the QMRG is most associated with university-level Geography departments and programmes. Most Geography departments in the UK will include at least one course introducing quantitative methods within the Geography degrees they offer, and likewise, many departments now provide an at least an introduction to GIS, with GIS also noted in the Consultation document as being one of the main avenues into the geospatial sector. Some universities, a relatively small handful, offer specific undergraduate degrees in GIS, although more commonly GIS is included as one element among others within Geography degrees. A small number of universities also offer GIS as a taught postgraduate Masters' level degree, typically of a year's duration.

The QMRG committee members have experience teaching courses in quantitative geography and GIS across all the type of degree structures just outlined, and the following obervations stem from that experience.

One area of need is not a skills one and rather is more of a perceptual matter – namely to counter the possibility that 'geospatial' is simply seen as another name for 'doing maths' in Geography. This sort of criticism has previously been levelled against quantitative geography, and is untrue. In our view, the opportunites for advancing geospatial skills are because the geospatial arena sits across multiple intersections – between geography, GIS, maths, statistics and computer science, but also between different bodies of geographical theory and scientific knowledge, and other fields including information communication, design and even elements of narrative and story telling. Accordingly we urge the Commission to take a broad view in supporting the promotion of opportunities in the geospatial arena in the widest sense, to lessen the chances of stifling new innovative and intersectional avenues.

However, having stated this preference for an 'intersectional' approach, we acknowledge it comes with challenges. For example, we have commonly observed that, among our students who opt to do GIS as part of their Geography degrees, a fair proportion of them lack confidence in methods of numerical analysis or are reluctant to engage in coding. Models of good practice and resources for teaching and learning at these intersections are now beginning to emerge, e.g. including books intended for texts such as the following:

Abernathy, D. (2016), *Using Geodata and Geolocation in the Social Sciences: Mapping our Connected World*. SAGE

Harris, R. (2016), *Quantitative Geography. The Basics*. SAGE.

Kitchin, R., Lauriault, T. and Wilson M., (2017), *Understanding Spatial Media*. SAGE.

Singleon, A., Spielman, S. and Folch, D. (2017), *Urban Analytics*. SAGE

However, more is needed to distill the ideas and topics beginning to be covered in texts such as these into a variety of different materials appropriate for teaching, learning and assessment.

Importantly too this should not be interpreted as a call to axe existing courses in quantitative methods or GIS, which rather should continue and in our view will in remain as key initial points of contact between learners and the geospatial arena. Rather, our call here is to find ways in which new geospatial courses and/or themes can be devised and implemented in harmony with those existing courses and within the constraints imposed by conventional degree structures and timetables. We would welcome the opportunity of working with the Commission on this, e.g. though convening of workshops.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

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Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

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Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Geospatial Commission:
Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Royal Geographical Society (with IBG)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**Learned Society and Professional Body**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We encourage the commission to be inclusive as possible in the 'geospatial' data it considers from 'traditional' locational data, to Earth observation, to locational information (and potential) associated with administrative data, to crowd-sourced data, to data from the IoT etc. Standards, interoperability, versioning are key elements to the greater use, and value, of all of these.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Background

The Royal Geographical Society (with IBG) is the UK's learned society and professional body for geography. We are also a membership body with >16,500 Fellows and members. We work closely with geographers in schools, universities, and in professional practice setting standards (for the discipline and individuals), accrediting programmes and individuals (notably Chartered Geographer, with a specific stream in GI/GIS), delivering mentoring and training, and profiling careers and opportunities. We also advocate for the discipline, engage the public through an extensive and broad range of programmes, and are actively engaged in knowledge exchange activities across our communities.

We recognise there are many disciplines and professional bodies cultivating and developing this ecosystem of geospatial skills – from data science, to engineering, to design and beyond. All these all are critical. However, producing and consuming geospatial data intelligently, and interpreting it to unlock economic value and deliver social benefits, does require specialised skills. These skills

are needed not just by technical specialists but also (and critically) by decision-makers and consumers of geospatial data, analysis and insights.

Geography has and will continue to play a crucial role in the delivery of geospatial and broader geographical skills of interpretation and analyses. These core skills and competencies need to continue to be cultivated, supported and developed, embracing new technologies and approaches, and the ubiquity (and multiple sources) of spatial (geographic) information. We welcome opportunities to work with the Commission, and the geospatial and geographical communities broadly, to develop and signpost existing and new opportunities.

Our approach to this call for evidence

Our response focuses primarily on the opportunities, needs and gaps delivered through geography. In collating the evidence base to respond to the commission, we consulted our community (university academics, teachers in schools, research groups, professional geographers specifically); drew on our existing knowledge and activity in this area; reviewed published reports and online information about courses and training; analysed CPD returns of Chartered Geographers and consulted with them as employers and employees; and interviewed leading academics, in geography and beyond (business, engineering, data science).

In addition, we have also consulted, and worked with, the AGI with whom we have a strategic partnership and a programme of ongoing work, specifically focused on skills. Our insights are biased to the supply-side of skills and to geography (as noted above).

General comments

Attention and focus is needed at multiple levels, from schools through advanced research training, delivered in different formats to meet the needs of learners and professionals. Investment is needed in 'core' areas (such as geography, geomatics, surveying etc), but also new and emerging areas (including data science) and with different user communities (e.g. disaster response and risk management). Skills need to be developed not only for the creation, curation and assurance of geographic information, but also critically with the contextualisation, analysis, interpretation and use of this information. This is where geography – and its spatial lens - has a particular role to play.

We structure our response in terms of opportunities and intervention at different stages in the geospatial skills pipeline – schools, university level education, research and innovation, and professional practice. The evidence base is provided in the accompanying briefing document.

In schools

Foundational skills and awareness of the value of geospatial data and insights must start in the earliest stages of education in schools. Currently, core geospatial skills are delivered in UK schools almost exclusively through geography. Thus geography is a key vehicle to educate and inspire young people about geospatial broadly defined.

Revisions to the curriculum at KS3 (where geography is part of the statutory national curriculum in English schools and thus taken by all students), at GCSE (ca 250,000 students taking this qualification each year; currently the 6th most popular GCSE); and at A-level (ca 30,000/yr) (one of the top ten A-levels) have enhanced the coverage and demand for data skills generally, and geospatial skills, analysis and applications specifically. This geospatial content is part of the taught courses and also included within the assessment frameworks for GCSE and A-level.

Policy interventions, notably the inclusion of geography GCSE in the English-baccalaureate, has encouraged more students to study geography at GCSE in England. This is not the case in Wales, Scotland and Northern Ireland. **Opportunities to encourage broader uptake to GCSE (or equivalent) should be explored and encouraged with the respective school educational policy bodies.**

Many teachers lack experience and confidence in the delivery of the content of the new school-level curricular; they need more training, resources and support in delivering the richer geospatial

content in inspirational ways. **A national programme to deliver teacher-CPD, resources, networking and mentoring is needed for teachers of geography in schools.** The Society has been working with the Nuffield Foundation to deliver such a series of events and resources for teachers to support the teaching and learning of digital skills generally. That project work comes to an end this year.

Geography has a **shortage of specialist teachers**. DfE are funding ITT scholarships and training through the Society. With this too, there is scope to support more training in geospatial skills, more awareness of applications and opportunities, and thus enhance the learning and understanding of young people.

In addition, beyond geography, opportunities exist, but more support is needed, to champion **cross-school (cross-subject) initiatives to introduce core concepts of spatial data** through other subjects (e.g. mathematics, computer science, design, economics, business studies etc). The Society has supported engagement between geographers and other subject teachers to explore such partnerships, but these need to be scaled up and other subject associations and teacher-bodies need to be engaged.

Esri UK launched a programme in April 2017 to give ArcGIS Online free to all UK secondary schools, attempting to remove two barriers - installation and cost. They also launched the Geomentors programme, working with the Society to network geospatial professionals (those with expertise) with teachers, along with resources, to support the teaching and learning of GIS. These initiatives are also championed through events such as GIS day. These programmes have been well received and successful. To date there has been uptake of ArcGIS Online in >1700 secondary schools, benefiting >70,000 students. This is the order of a fifth of secondary schools across the UK. Clearly, and importantly, there are opportunities to do more: ca. 80% of secondary schools are not accessing these resources. The Society has worked with the four exam boards and with Esri UK to promote the opportunity. We recommend the **Commission work with DfE, and the Society and Esri UK, to join together through communications and influence to extend the reach, awareness and uptake of the free software, resources and Geomentors**.

Unlocking greater value (economic, social or environmental) of geospatial data will result from new applications, innovation and creativity (as well as greater awareness and skills). Initiatives are needed to develop this **innovative imagination and capacity** amongst young people at schools. One productive route would be to launch a competition for **geospatial-apps** (modelled loosely on the ideas of Geovation but for a school students). This could work with employers/industrial and media partners to raise the profile. This RGS-IBG would be delighted to partner on this, building on experience with initiatives such as Young Geographer of the Year.

In addition, there is a need to showcase the potential and excitement of geospatial applications to school level students whose interests will lead to careers not only in geography, but engineering, mathematics, data science, business, design etc. This requires investment in a broad suite of **imaginative careers profiles** that can be used by teachers, career advisors (working through national networks) and directly with students too. This should actively link with STEM, social science and humanities disciplines too, and drawing on school Ambassadors programme (both Geography and STEM). These should be pitched at students of all ages to fire their imagination, understand the possibilities, and recognise how expertise (or just knowledge) of geospatial data, technologies and applications can lead into successful careers, address key social, economic and environmental challenges, and benefit society.

Initiatives with schools, to showcase applications and careers, are key elements of what is also needed, **broader public relations activities to share success stories and raise the profile of geospatial** to the public focused on themes important to them. A festival, street-exhibitions, citizen-geography activities all could be elements of this. As one small example the Exhibition Road festival this summer (involving Science Museum, Imperial etc) will focus on space.

Higher education

Reports (such as Geobuiz, 2018) document that the UK stands out in terms of provision of geospatial training.

In preparing for this submission we updated our directory of geospatial programmes and courses in the UK, related to geography. Through this we identified 7 specialist undergraduate courses; 215 undergraduate modules; 90 Masters degree programmes; and 156 short courses. Geospatial education is increasingly being delivered in settings outside traditional realms of GIS, remote sensing and geomatics (in engineering, architecture and planning, business, public health). A fuller understanding of these courses, parts of courses, would be valuable within as well as across higher education institutions to encourage collaboration and interdisciplinary teaching. An **accessible and comprehensive directory** of formal provision is needed, across disciplines and institutions, to identify good practice, gaps in provision and foster new opportunities.

Based on discussions with leading university based educators, we heard expressions of interest in the development of MOOCs to bring basic geospatial understanding to new entrants, and new models for interdisciplinary teaching. **Forums need to be convened to bring interested parties together and catalyse development and delivery. Critically, employers/industry need to integral to these discussions from the outset to ensure the full suite of skills, knowledge and understanding is being delivered (**i.e. coding (e.g. in R, Python), visualisation (e.g. Tableau, Alteryx) and database management, as well as core-GIS skills).

Accessing new forms of data, especially via APIs, is also a key competence that needs to be developed, as well as an appreciation of the underlying systems that generate such data. Furthermore, particularly with new opportunities (e.g. administrative data, crowd-sourced data, human-sensor etc) and heightened awareness and concerns about personal data, confidentiality and ethics, education around professional values is important for geospatial professionals. Geoprivacy and ethical spatial data handling are key issues.

GISRUK (an annual academic-led conference that draws together researchers from a broad range of disciplines, including but not limited to, Geography, Environmental Science, Ecology, Computer Science, Planning, Archaeology, Geology, Geomatics and Engineering) **provides one obvious forum for an annual meeting/discussion to foreground skills training provision and skills needs** and to engage university educators.

In our interviews higher education staff, as with teachers in schools, expressed concern about **having sufficient time and resource to stay abreast of state-of-the-art technical skills** required in the rapidly evolving geospatial technical landscape. This needs to be highlighted as a priority and resources (time, funds, and opportunities) need to be made available for this. Short industrial or public sector placements/secondments could help in this realm.

Provision of geographical/geospatial training in further education and through technician level training is limited. A small number of **geospatial mapping and science apprenticeships** (level 3 and level 6) have been developed, and other standards make reference to geospatial training. The former have been developed by RICS to serve the needs of the surveying/geomatics profession. We are keen to see geographers engage with these more and to explore the extent to which they can provide **pathways for other elements of geospatial training at entry and advanced level**, or if new qualifications need to be developed. We know of a small number of geography departments interested in **higher-level, geospatial apprenticeships, focused more on data analytics**. These conversations need to be taken forward; key stakeholders drawn together; and barriers for uptake in universities, or further education institutions, identified and addressed.

Research and innovation

In the higher education research and innovation space, there are a number of pockets of geospatial expertise and excellence – established and emerging. Programmes exist, through UKRI awards, (e.g. Future Leaders) to recognise and raise the profile of expertise and innovation more widely and to foster collaborations with industry. **A directory of expertise, proactive**

nominations for recognition (with associated media profile) would serve to raise awareness of this excellence.

More geospatial awareness and training needs to be embedded in **interdisciplinary PhD training**. The UKRI doctoral training centres serve as one vehicle through which to do this. Mapping of existing provision of training across ESPRC (in particular), NERC, and ESRC doctoral training centres would be a helpful first step, as would involving more industry partners and advisors in evaluating the current offer. **Focused calls, or cross-centre training programmes**, could then follow.

Employers' needs

Numerous reports have been published based on skills needs and gaps based on employment data, surveys and interviews. Some of these are summarised and collated in our companion briefing document.

Common themes relate to the lack of digital/data skills generally; to the lack of knowledge of geospatial concepts (and implications for geospatial data) amongst computer scientists, software engineers and data analysts; and to the lack of data science skills (coding, visualisation, database management etc – noted above) amongst those trained through 'traditional' geospatial routes (geodesy and surveying, cartography, GISc etc).

A stronger evidence base of needs and gaps is critical to ensuring programmes are in place such that the right skills are anticipated, cultivated and delivered for entrants at all levels in employment. Here we draw specific attention to the exciting opportunities offered by the innovative methodology developed by Nesta, which involves (near) real-time analysis of job advertisements (ca 41 million to look at skills and skills clusters and employment sectors (see the accompanying document for more details). Such results could be overlain on local authorities/journeys to work to gain insights into the regional pattern of demand and/or to draw on information in other R&D platforms (glassAI, GITHUB, academic papers etc). We would welcome the opportunity to work with the Commission and Nesta to use this approached, modified slightly, to gain new insights into existing and emerging skills needs and gaps. Key to this will be the development and use of a shared (dynamic) taxonomy of skills.

Accreditation and professional standards for practioners

These are critical in recognising and signalling different levels of competence and expertise. Producing and consuming geospatial data intelligently, and interpreting it to unlock economic value and deliver social benefits to our citizens, **does require specialised skills**. These need to be clearly articulated and captured in a **framework of professional competencies**.

Chartered Geographer (GI) (CGeog GI) provides one standard to independently recognise an advanced level of professional expertise and competence. The accreditation has been adopted across the public and private sectors, but more needs to be done to encourage its alignment and uptake (e.g. with industry bodies such as the Chartered Insurance Institute and Association for British Insurers).

Chartered Geographer is underpinned by a **competency framework and professional code of practice.** There is scope to develop this further and the Society would welcome working with the geospatial community to do that. Currently, we are collaborating the Head and Deputy Heads of the Geography Profession within GSE in government to ensure alignment of standards and expectations across departments/agencies and with Chartered Geographer. Discussions are also underway about an earlier (entry-level) professional recognition, for those in the first few years in the profession, that codifies a commitment to professional development and mentoring. This will be developed to be appropriate for those beyond the public sector to ensure transferability between sectors and workplaces.

There are very special opportunities afforded within government, and beyond, through the work of the **new profession of geographers in GSE**. The head of the profession, [Text redacted] and a number of the deputy heads charged with professional standards specifically, will be key to the

development of geospatial training, standards, and accreditation of expertise for those involved in geospatial within government. They are particularly well placed to identify synergies and capitalise on opportunities with allied professions (e.g. the digital, data and technology profession) and in embedding good geospatial practice in the frameworks and competencies of other professions (economics, social research, statistics as examples).

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Please see responses above in Q2.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

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Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There is much good practice overseas. We encourage the commission to also involve international experts (e.g. from Singapore, USA, Netherlands etc) in its advisory and evaluative bodies.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Royal Institution of Chartered Surveyors (RICS)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Professional Institution**

Call for evidence - three key themes

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1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The listing seems a little old fashioned and overly orientated on small/medium scale 'GIS' applications. The national geospatial strategy is a great opportunity for the UK geospatial industries to move on from the traditionalist 'GI' mentality of previous years (UK Location Strategy) and fully embrace all aspects of geospatial innovation, this can be engineering, land & property, planning and/or geography orientated. RICS would emphasise the importance of large scale data capture, the UK geodetic network (and its densification) and maintenance and the need to think on the integration of GIS (wide area) and BIM (small area) datasets. The evolving concept of 'digital twins' (a seamlessness between the existing and digital environments) will require a new approach when thinking of geospatial information and its capture, accuracy and applicability. We will be repeating the emphasis on the lack of a consistent national approach to 'planning & development' geospatial data issue during our response but suffice to say that the lack of a coherent plan has serious ramifications across a range of sectors from cross border infrastructure to provision of affordable housing in the areas that need it to green belt management and urbanisation. Just like the partner bodies listing, RICS would suggest that the geospatial commissions view the listing below as constituting a geospatial industries professions partnership:
AGI, RICS, TSA, CICES, RIBA, RTPI, ICE

The Geospatial Commission should support the concept of applications that lead customers (citizens and professionals) through a business process and provide them with answers rather than expecting them to perform the analyses themselves

using geospatial information.

A great example is the assessment of solar energy potential application (http://www.uvek-gis.admin.ch/BFE/sonnendach/?lang=en) developed jointly by the Swiss Federal Energy Office, MeteoSwiss and swisstopo (National Mapping Agency). The user is unaware that the application makes extensive use of geospatial information. It is the answer that the user is interested in.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

RICS is very supportive of the current advanced apprenticeship initiatives (geospatial surveying level 3 & 6). There is a real need for 'hands on' data capture, surveying and engineering surveying skills. Geospatial, unlike GIS, is also about high accuracy, precision engineering applications – there is a need to embed geospatial understanding and techniques into other related professions such as civil engineering, planning, infrastructure, architecture, geography, property and land management. The commission should explore MOOC technology (as used by USAID and recently Tech University Munich) to bring basic geospatial understanding to new entrants and other professionals.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We are witnessing more large (international and national) property and multi-disciplinary practices incorporating geospatial knowledge and technologies within their organisational structures and we are also witnessing a skills shortage across the geospatial surveying sectors. Careers should be targeted at school leavers and in conjunction with existing initiatives (Class of your own, geomatics.org, #lovesurveying etc). Graduates from cognate courses especially geography should be targeted.
RICS has developed a broad pathway to professional membership called the Land & Resources APC & AssocRICS pathway, this is proving popular with a wide variety of stakeholders (utilities, Gov agencies, multinational practices) who may have felt other RICS pathways were over specialised and restrictive. We have made sure geospatial surveying and knowledge is one of several core elements to this new pathway.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

HMLR hold a substantial portfolio of commercial property leasehold information (all 7 years + leasehold data can be tagged as confidential) – we are aware of the legislative changes needed to release this data but are of the view that this might be something for the commission to lobby HM Gov on. As already mentioned, the UK is bereft of any kind of coherent national planning geospatial framework.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

NA

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Commission should add the 'catapult' initiatives to its core stakeholder listing, the satellite technology catapult (based at Didcot) is especially relevant in this regard (as are several others especially Intelligent Cities) and are increasingly working globally. They are also exploring their potential in the land & property sectors (with offshoot start-ups such Orbital Witness) and with UN FAO/Habitat on tech enabled land administration in the developing world. The EU Copernicus initiative (and EO sentinel data availability) has been a 'game changer' for the integrated use of EO by numerous industries, the commission should integrate with and follow their lead.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The Commission should carry out a simple audit of current and coming technologies (AI/ML, Blockchain, BIM, digital twins, UAVs) and who is already involved (BuildingSmart, OGC, catapult(s)). The technology element is a moving target but AI/ML & blockchain tech do seem very relevant to geospatial applications. Advances in GNSS technology and the advent of new systems (Galileo etc) should also be tracked, as should geospatial survey technology (machine control tech).

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The interconnection between GIS & BIM is especially exciting and bringing different scales, policy frameworks and ownership issues to the fore. The Commission should make sure to be linked into supporting infrastructure such as 5G telecoms rollout, smart city initiatives & distributed energy network development. Geospatial information can bring a lot of enhancement to other future technologies (public transport tech, driverless cars, high tech agriculture). Geotech can also bring benefit to more mundane sectors such as enhanced property taxation, land use and registration systems. Denmark has recently moved to a fully automated geo enabled property valuation and taxation system https://digst.dk/media/16165/ds_singlepage_uk_web.pdf

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

RICS would underline the need for public sector organisations to understand the providence of geospatial information and how it is underpinned by large scale survey data capture, ongoing revision and maintenance and the primacy of the Geodetic network as framework for all applications from large scale civil engineering to Rural Payments Agency RPA activities. Maintenance and currency are key issues for the geospatial strategy and the commission should give these issues a lot of attention. Geospatial data capture cannot always be achieved by high tech solutions (UAVs, EO etc), certainly not to the accuracy needed by many industries. RICS has produced a now global standard on Survey Detail Accuracy which outlines scales, accuracies and methodologies – the geospatial commission should look to adopt industry standards and practice and look way beyond GI software approaches and world views.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Positioning technology, the underlying UK geodetic network (OSNet) and the maintenance and updating of the UK Geoid (OSGM14) are very important aspects of the remit of the commission. Geoid updates and related transformation parameters (OSTN14 current) are expensive and require rare UK expertise, but they create the geodetic basis for the establishment and mass usage of OSNet and a very accurate GNSS capability. Priority must be given to maintaining the geodetic network and related activities, this will become even more important as critical activities (security, transport, health, energy etc) become more reliant on accurate geospatial information. Future requirements will be more accurate rather than less.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a role to play when ‘densification’ of a network is required, however ultimate responsibility and therefore liability remains with state agencies. The geodetic network (and related activities) are of national significance, private firms can engage in the provision of GNSS enhanced data services (real time RTK) as is currently available.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The connection of the geospatial industries with ‘standards’ and standards process are quite good, from ISO TC211 and OGC working groups to online communities such as Building Smart and the ongoing challenges of inspire – the geo industries are quite a way ahead in our understanding of standards issues. Addressing seems to be solved, as opposed to the chaos of previous years. Interoperability of software rather than datasets is a major issue. The success of the Digital twin concept and the linking of BIM (individual buildings) with wide scale GIS and Smart City (CityGML) will hinge on software interoperability issues (and related data connectivity). The Digital Street concept as championed by HMLR is a good example of how streamlined, customer focussed data provision can add the efficiency of the land & property market.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

N/A

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Rural payments agency (RPA) – we believe that access to the Rural Payments Agency database would have multiple benefits for UK land administration, land use planning (as other nations) and potentially taxation. This RPA dataset can act almost as 'ghost register' and is disconnected from HMLR datasets, although it does show the true and current use of UK land.

Commercial property lease information: HMLR may have issues with the legality of releasing this dataset due to legislation.

Environment agency – lidar flood mapping geospatial datasets (EA Geomatics is an offshoot section which specialises in coastal/inshore and inland land/water surveys).

Planning information: the national planning inspectorate https://www.gov.uk/government/organisations/planning-inspectorate really needs to take a more active role in the provision of national planning data provision and localised geospatially enabled spatial plans. The UK is a mess where coherent planning and development data availability is concerned, although this data is very valuable to the P&D and investment sectors.
Resilience and emergency planning: we have highlighted the importance of the UN Sustainable Development Goals (SDGs) within our response and RICS would underline the importance of a Spatial Data Infrastructure (SDI) that is fit for purpose as attempt to manage the effects of climate change and improve the resilience of our national built and natural environments. Flooding will increase in frequency and intensity in the UK for example https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees/#
Emergency planning (environmental, terrorism, sporting events, fire) is also a sector that requires a coherent geospatial strategy.

Utilities: There have been several geo related projects in this sector (project Iceberg Ordnance Survey GB) and the National Joint Utilities Group NJUG but again this is sector that requires accessible geospatially enable information. Underground utility data is very difficult to aggregate and access (due to a variety of reasons, privatisation has not helped in this regard).

3rd party input of geospatial information – private sector survey firms (www.tsa-uk.org.uk) capture a vast amount of high quality/large scale geospatial information every day and could be utilised to enhance the national dataset. This would need 'vetting' and careful management but in for example the provision of post housing development 'as built' geospatial surveys this could save a lot of conflict issues that tend to follow on in the future.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

This strategic aspect might be better divided into policy considerations (high level principle on the use of geospatial information (economic, social, political, environmental) and a more technical use-based series of internal training (or MOOC massive online course) for those at the front line of geospatial usage (waste services, health provision, schools etc)

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Property and land

We at RICS would see our core area of interest as the land & property sectors, we not only encompass professional chartered members in the geospatial sector but also valuation, development, residential and commercial property, building and quantity surveying and facilities management. The land & property markets are central to the economic well-being of UK PLC and geospatial information, and its availability (with relevant & added value) is a central element of ensuring future integration of technology and use. The UK benefits from one of the most effective land & property taxation systems in the world (certainly in terms of % of GDP – OECD) and the increased integration of mapping, legal registration/ownership, valuation and taxation information would help to encourage use. Automated valuation models (AVM) when combined with the England/Wales council tax regime could update a very out of date system. Denmark has already gone down this road. We would fully encourage the further integration of OS, HMLR and VOA into a more solidified union. Geospatial data also underpins the Compulsory Acquisition regime in England/Wales, this is a fraught and complex sector which is dependent (due diligence) on access to a lot of localised and wide scale geo datasets (amongst much more), geospatial data availability when aggregated with

numerous other related land & property datasets can ease the 'transfer and compensation process' and enable international land transfer standards such as ILMS https://consultations.intstandards.org/consult.ti/ilms/consultationHome to be used.

We have already mentioned the dire need for consistency in the provision of planning and development geospatial information. RICS has been very impressed by the work of the satellite applications catapult and its test project with Milton Keynes LA on using high resolution imagery to auto-update spatial planning (change detection) – a powerful tool which has global implications and use.

We have also mentioned the RPA and the opening of rural payments information and land use data (land valuation and pricing information is very difficult to aggregate, unlike the mass of information available on residential property indexes).

We would also highlight the increasing prevalence of neighbour disputes (particluarily those involving boundary issues – RICS receives over 5000 compliants PA and the county court system is struggling to deal with this sector). Good geospatial information can solve many un necessary conflicts and the combination of current geospatial information with existing land registry title needs to be explored. Land registry and OS are at the core oft his issue but so to are 'bad' development plans and the lack of understanding (and ability) to accept 'fixed'/'determined' boundaries into land registry systems (with ease). The processes and legal issues are solved, LR guides are available but the opening up of this abilty to permanent solve disputes would be good for UK PLC. The strong GNSS RTK network makes absolute location 'repeatability' to within acceptable industry standards (RICS Measured surveys 3rd ed 2014) achievable.

Infrastructure and construction

We have previously underlined the critical importance of OSNet and the UK geodetic network to infrastructure provision (we mentioned the densification of the OSNet network on HS2 and the machine control this enables), we would also highlight that geospatial data is spoken of mainly in connection with CAPEX construction expenditure (the actual physical Contruction) and whilst this is critical geospatial data also has a major role to play in the long term strategic asset management that national and local infrastructure requires. OPEX expenditure (asset maintenance, upgrading, facilities management etc) usually greatly outstrips CAPEX and the long-term integration of a strong geospatial strategy will be key to the use of BIM, digital twin, smart cities & the management of the 'digital' built environment. A bit of a change of mind set.

We would also suggest that the concept on 'infrastructure' is broadened to include telecommunications and broadband connectivity and future technology roll out (5G). geospatial data has a major role to play (5g technology is line of sight

orientated and accurate city models such as those developed by the Manchester test bed Cityverve) will become even more important.

Another aspect of infrastructure development that would benefit from a more coherent approach to geospatial and land information is land referencing. Land referencing is used to create the necessary documentation to support a development consent order (DCO), compulsory purchase order (CPO), transport and works act order (TWAO), vesting order (VO) or hybrid bill. This a key element of infrastructure provision and is also a major part of any project cost (witness the excalating costs of HS2 due to a mis calculation of the land acquisition and CPO process. Geospatial information is a key part of these process and help tie all of the disparate land elements together.

Natural resources

We believe you could extend this topic to include renewables and the national grid. Localised power distribution and provision (and perhaps blockchain supply chain tech) is becoming increasingly important, geospatial tech has the power to unlock the connection between location and access to solar, planning, grant regimes, allowable development data and much more. Offshore development (The Geospatial Commission should develop links with Crown Estate) of wind and wave energy is reliant on the integration of land, coastal and offshore data sets, as is the management of coastal and offshore natural assets and the protection of the numerous (and recent) marine eco zones as designated by the Marine Management Organisation MMO.

Q17: Are there any other areas that we should look at as a priority?

It would be worthwhile looking into the land & property transfer 'due diligence process and existing standardised data transfer protocols such as ILMS (International Land Measurement Standards), RICS and Law Society protocols. The Coal Authority has recently opened its datasets (CON29M Law Society protocol) to firms, this is a great example of public sector data having significant 'added value' enabled by expert professions and private sector involvement (Terrafirma in this case). Other sectors such as Compulsory Purchase & acquisition would benefit from better engagement and we iterate our thoughts that the Planning Inspectorate be added to the core grouping.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Governance and regulation always tends to lag behind technological advances, the sectors we see as causing potential clashes are the implementation of (amongst many others); Smart City technology and its connectivity with BIM (BSI have done some good work in this space on policy considerations), the upgrading of the UK (regional) land & property taxation systems to incorporate geospatial, census, land registration and market value (perhaps based on Automated Valuation Models and the use of AI/ML) – this would tie geospatial directly to revenue raising strategies and really needs to be considered, and natural capital and ecosystem value. UK agricultural policy is moving towards a more 'environmental' stewardship model (post Brexit) and will require a much more integrated geospatial approach to Rural Payments Agency, environmental planning and evolution of natural capital policy requirements and thought.
We are sure that others will go into more in-depth narratives on autonomous cars and future mobility. This new technology will require an astonishing amount of geospatial data to operate effectively from high accuracy GNSS and inertial positioning to high precision engineering and 3d environment data. RICS would also raise the issue of advanced public transit systems (trams, underground/overground, mono-rail, auto bus etc) and their need for geospatial information which can be used for all stages of development including post construction land value capture (valuation, taxation and geospatial working in tandem). Increasing use of cycling will be further encouraged by authorities and will also benefit for advanced geospatial information.

We would urge the geospatial commission to adopt holistic vision when thinking on the future use and application of geospatial information. The UN Sustainable Development Goals SDGs should be highlighted as a priority by the commission and where and at what level geospatial data can help UK PLC achieve its obligations.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

The UK is very visible on the global geospatial stage through our involvement with organisations and agencies such as UN GGIM (UK to host in 2020) (and other UN Agencies such as UNFAO & UN Habitat), OGC, FIG, CLGE, IAG, ISPRSC and World Bank. There are numerous key conferences and events during each year. The UK geospatial industries have come together under the auspices of GeoBusiness 2019 (May 2019), which acts as an annual lodestar for numerous professional organisations. We would also suggest that the Commission adopt the global language and use of the UN Sustainable Development Goals (SDGs) and as a priority seek to envisage how and where geospatial information and expertise enables each of the 17 SDGs (and the specific tiers SDG 1.4.2 land tenure – for example). The UK has an active SDG implementation group focussed on enabling private sector organisations to incorporate the SDGs into their corporate social responsibility CSR plans https://www.unglobalcompact.org/library/5628 http://www.unglobalcompact.org.uk/ - geospatial information should tied to this

initiative as an enabling force for good.
Capacity development is a major issue facing the land & property sectors worldwide, we would suggest that the commission work with DfID colleagues (LEGEND programme) on a MOOC outlining geospatial capacity development (USAID https://www.canvas.net/browse/usaid/courses/usaid-land-tenure-2 did this and attracted over 15 000 participants).

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

When we look to our fellow professional geospatial surveyors globally – the main issue, almost existential in many regions, is geospatial technical and professional capacity development. There are just not enough geospatial surveyors.

In other sectors - Denmark has a new land & property taxation model (but is a very data rich environment) based on a very strong geospatial technology capability (imagery, GIS, valuation/AVM) which has revolutionised its revenue generation capability.

Sweden has adopted blockchain technologies for land & property transfer and numerous OECD nations are moving towards similar adoption.

Ireland (republic) is combining numerous government services into a single department (Taillte Eireann) bringing national mapping (OSI), land registration, valuation/taxation and planning together.

However, global benchmarking in our sectors is always difficult, the global geospatial outlook survey is a good snapshot but does have a commercial imperative, World Bank Doing Better Business 'registration of property' has a strong geospatial element(s), various nations have implemented or are thinking of Spatial Data Infrastructures (SDIs) with varying success and international initiatives such as InSpire and EuroGeographics (EU), FIG and UN GGIM (global) continue. It depends on what we view as important criteria for benchmarking? Revenue generation (property/land taxation UK 2nd after USA), Doing Better Business (UK 42nd, 1 place below Mongolia) due to legacy of historic land registration issues.

We would advise that the commission looks at numerous direct and connected benchmarking protocols and initially research just where the UK sits and can develop further.

Royal Mail response to the Geospatial Commission Call for Evidence

About Royal Mail

As the UK's sole designated Universal Service Provider for post, Royal Mail is proud to deliver a 'one price goes anywhere' service on a range of letters and parcels to over 30 million addresses (including 1.3 million businesses) across the UK, six-days-a-week.

Postcodes are a strong foundation for UK geospatial data

The Postcode Address File (PAF) is rightly recognised in the consultation as an important piece of the UK's geospatial infrastructure. We welcome the Commission's interest in exploring how to work together on PAF and we are keen to ensure the UK remains at the forefront of how we use geospatial data on an ongoing basis.

Next year is the 60th anniversary of the postcode. Royal Mail invested heavily in getting the public to use their postcodes to support efficient mail delivery. Postcodes are one of the most readily memorable pieces of information that a citizen has about their address and location. The addressing and postcode infrastructure was originally developed to help Royal Mail route and deliver mail. Today this postal address data is still essential to ensure efficient sortation and routing of parcels and letters for Royal Mail, as well as for the whole of the UK's delivery sector.

Postcodes are a core part of the national geospatial infrastructure, and have become easy to use indicators for areas and locations. They are the first choice for businesses, the public sector and citizens when it comes to searching for places in maps and satellite navigation systems. They are also commonly used by organisations to help calculate insurance premiums, define catchment areas and often feature in reports on national trends and changes. While the postcode was not originally designed for these purposes its ubiquity and simplicity means that it is not going to be easily or quickly replaced by alternative reference indicators.

PAF is a key enabler for many businesses

Since the 1990s PAF has been available to other, non-delivery businesses, and those businesses have incorporated it into the software that drives the customer management, procurement and e-commerce systems of tens of thousands of UK based businesses. The simplicity of the question "can I take your name and postcode please?" followed by a rapid address lookup against the file of the 30m+ UK delivery points, makes for highly efficient interaction between businesses and customers, public sector and citizens.

PAF is maintained to a high level of quality and accuracy by Royal Mail. This in turn enables us to make a reasonable return on PAF provided we maintain value for money. Searches against the file are available from as little as 1.3 pence each. It is important that we can continue to manage PAF on this basis to ensure we can maintain quality and accuracy.

We make over 5,000 changes to our PAF data every day. These changes are made available to customers daily, ensuring changes can be used by our customers as soon as possible. UK postal address info is widely recognised as the best and most accurate in the world and PAF is chosen and trusted by those who rely on address information to help in the identification and verification

of both people and places. This trust has been established by providing accurate and consistent data for use by customers over decades.

PAF is a key asset for Royal Mail

Royal Mail uses the PAF database daily to route mail efficiently and accurately to every single UK address. Royal Mail has made, and continues to make, substantial investments in building, developing and maintaining the PAF database. We commercialise this through licensing activities which helps underpin our ability to deliver the 'one price goes anywhere' Universal Service to 30 million addresses.

As the consultation paper rightly notes, "The potential economic and social rewards are large if we act to take advantage of this increasing opportunity." I hope that this includes collaborating to build on the existing assets that have placed the UK in a leading position on geospatial data, in particular the postcode and the Postcode Address File.

We would be happy to discuss the role of the postcode further if helpful to the Commission. [Text redacted]

RTPI response to HM Government National Geospatial Strategy: call for evidence

October 2018

About the RTPI

The RTPI champions the power of planning in creating prosperous places and vibrant communities. As learned society, we use our expertise and research to bring evidence and thought leadership to shape planning policies and thinking. As a professional body, we have over 25,000 members across all sectors, and are responsible for setting formal standards for planning practice and education.

General comments

We welcome the opportunity to respond to this consultation on the National Geospatial Strategy. We are excited at this increased attention to the potential of the UK's geospatial data infrastructure. If the Government follows through on this promise it could be of great benefit to planners and the planning system.

As a general point we want to emphasise the value of geospatial data to public sector decision-making. Whilst the economic potential of geospatial data is worthy of emphasis, the utility of data in informing decision-making, from local planning decisions up to national policy is important. This is true both for understanding needs related to particular areas, and for ensuring that policies link up together. Improving decision-makers access to quality, easy to use data, will improve decision-making at all spatial and governmental scales.

Our research 'A Map for England'[1] took English policies with a strong spatial dimension and mapped them to highlight overlaps. It showed that some policies and programmes, when considered against each other in relation to different parts of the country, may have unintended consequences. This clearly highlights the importance of publishing data in with consistent spatial identifiers. In the ideal, all policy should be clearly linked to the spatial area it will influence in order to make overlap obvious. The Geospatial Commission is in a great position to push for this.

[1] Wong et al. (2012), A Map for England, https://www.rtpi.org.uk/knowledge/policy/map-for-england/

Response to questions

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Data skills are already important to planners and will be increasingly crucial in coming years. We have identified this as a priority and are exploring how best to deliver training on this with members. We would welcome engagement from the commission on how best to spread digital skills in the planning profession.

We are currently working with Future Cities Catapult to look for opportunities to:

- Raise awareness of digital tools and approaches in planning, through signposting, guidance, conferences and outreach, possibly including a joint PlanTech conference in 2019 and a new PlanTech award as part of the RTPI annual planning awards
- Utilising the RTPIs extensive partnerships with academia, industry and professionals to research, analyse and communicate the key opportunities for PlanTech
- Embed PlanTech into academic and CPD courses to ensure that new and existing planners are well placed to lead on this agenda.
- Share the lessons and opportunities of PlanTech through the RTPIs wider international network

The RTPI is also developing apprenticeships for planners. We are interested in the Commission's ambitions to build geo-spatial skills into a wide variety of training and would welcome further discussion and support on this.

Different planners will need different digital skills. We expect some of the most common needs to be around:

- Digital tools such as BIM and GIS
- Social media and other digital community engagement tools
- Understanding of key concepts e.g. smart cities

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Land Registry ownership information is important for planning – therefore we strongly support moves towards completing the registries around the UK and making the data more accessible. It can help local authorities developing plans and assembling sites, for example to deliver new housing. It can also help citizens participate in planning processes. In particular, the National Polygon dataset should be prioritised, along with identifiers (e.g. Land Registry Title Numbers) that would improve linkage with other data.

The Geospatial Commission should also push for data to be collected and made accessible on beneficial owners of land, and options to purchase land. As it stands land options can be registered but do not need to declare that they are contingent on the allocation of land in a plan

or the grant of planning permission. They are not required to be registered or disclosed at all. The compulsory registration of such options would assist more effective plan making at all levels and the smoother and more transparent operation of the land market. It would also increase public confidence in the system.

The Geospatial Commission should make linking up data a major priority. As described above, our Map for England project attempted to bypass policy siloes by matching up datasets from different Government departments. This kind of linking of various types of data should be a standard working practice and the Geospatial Commission could help prepare a data infrastructure which makes this easy.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Our main public data infrastructure should be developed and maintained with public funds to pursue public interests, be they economic, environmental, or social, or to help improve policymaking. This data should then be made as open and accessible as possible.

There are a number of ways in which the land market could be made more effective with new data which could easily be mapped. The organisations involved in the Geospatial Commission should link up with others including the MoD, NHS, and ONS, to collect and publish data on a range of things, including[2]:

- **Comprehensive and transparent ownership data with key identifiers**. This would make it easier for local authorities to develop plans and assemble sites, and for citizens to engage with land use planning. Data on land ownership needs to be available in aggregate and over territories not simply to "purchasers". Understanding concentration of land ownership (and planning permissions) will help understand how to promote competition and diversity in development.
- **Beneficial owners of land, and options to purchase land**. As it stands land options can be registered but do not need to declare that they are contingent on the allocation of land in a plan or the grant of planning permission. They are not required to be registered or disclosed at all. The compulsory registration of such options would assist more effective plan making at all levels and the smoother and more transparent operation of the land market. It would also increase public confidence in the system.
- **Land prices by site and by hectare**
- **Mapped planning permissions with dates and details** of what the permission is for, who it was given to and the status of the development. This would mean that the spatial impact of housing delivery can be properly monitored. We explored this in our recent research, Location of Development[3], on why housing location is as important as supply. It would also mean that the distribution of permissions could be understood better.

[2] See also: KPMG and Shelter, Building the Homes we Need, p.60 https://home.kpmg.com/content/dam/kpmg/pdf/2015/03/building-the-homes-we-need.pdf#page=60

[3] www.rtpi.org.uk/locationofdevelopment

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The coverage of high speed broadband must be a priority as it will enable the collection and use of geospatial data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As described above, our main public data infrastructure should be developed and maintained with public funds. However, the private sector certainly creates data which could contribute to the underpinning data infrastructure. More should be done to encourage private sector companies to share data relating to public spaces and services such as transport. This would be useful to planners seeking to improve urban design.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Licensing restrictions associated with the use of OS data is often cited by local authorities and other public authorities as a reason they can not release data they collect as open data.

In this and other cases, the Geospatial Commission should seek the minim um amount of restrictions on how datasets can be used and how derived data can be shared.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The Commission should collaborate with various different Government organisations, both to develop this strategy and on an ongoing basis. This might include, for example, the new MHCLG Digital Policy team.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Coordination between local authorities is essential to the digital transformation of planning, and in particular to making planning data more accessible.

We agree with the points made in Owen Boswarva's response[4], around:

- Making greater use of the Single Data List.[5] In particular we would like to see more consistent information collected by local planning authorities (e.g. on resourcing). Though this must be explored with an understanding of the cost of collecting data.

[4] https://www.owenboswarva.com/blog/post-gc2.htm
[5] https://www.gov.uk/government/publications/single-data-list

- Government mandating schemas for returns of geospatial and other data from council sources, to ensure consistency and interoperability.
- Replacing PSMA with open licensing of MasterMap data

In 2018 the ODI conducted research into the role open data plays in the delivery of public services. We agree with several of the recommendations from this report, including:

- the need to fund local authorities to experiment with ways of developing new uses for geospatial data
- the need to support collaboration between local authorities, including through supporting peer networks.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We are interested in how geospatial data will be involved in the development of autonomous vehicles. Increased use of AVs will require careful input from planners.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The US state of Montana provides an example of how information on land can be made accessible to everyone.[6] It is particularly interesting in displaying all land boundaries and land ownership, but also linking this with a wealth of other information (and adding more and more new linked datasets as time goes on).

One major advantage is that all the data is linked to properties. For any parcel of land you can easily find out information on a range of metrics including:

- the owner
- the property type
- the land value
- the land use
- the dwellings and other buildings

This highlights how valuable a move towards opening up Land Registry Title Numbers and the National Polygon dataset could be.

This kind of tool could help make planning, and in particular community participation in planning, more effective in the UK. Given the richness of UK geospatial data, this could easily be a world leading resource.

[6] Montana Cadastral, http://svc.mt.gov/msl/mtcadastral/

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Royal Town Planning Institute
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No response.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

.No response.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Data skills are already important to planners and will be increasingly crucial in coming years. We have identified this as a priority and are exploring how best to deliver training on this with members. We would welcome engagement from the commission on how best to spread digital skills in the planning profession.

We are currently working with Future Cities Catapult to look for opportunities to:

- Raise awareness of digital tools and approaches in planning, through signposting, guidance, conferences and outreach, possibly including a joint PlanTech conference in 2019 and a new PlanTech award as part of the RTPI annual planning awards
- Utilising the RTPIs extensive partnerships with academia, industry and professionals to research, analyse and communicate the key opportunities for PlanTech
- Embed PlanTech into academic and CPD courses to ensure that new and existing planners are well placed to lead on this agenda.
- Share the lessons and opportunities of PlanTech through the RTPIs wider international network

The RTPI is also developing apprenticeships for planners. We are interested in the Commission's ambitions to build geo-spatial skills into a wide variety of training and would welcome further discussion and support on this.

Different planners will need different digital skills. We expect some of the most common needs to be around:

- Digital tools such as BIM and GIS
- Social media and other digital community engagement tools
- Understanding of key concepts e.g. smart cities

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved?

Please explain why this would be of value, and how access/quality could be improved?

As a general point we want to emphasise the value of geospatial data to public sector decision-making. Whilst the economic potential of geospatial data is worthy of emphasis, the utility of data in informing decision-making, from local planning decisions up to national policy is important. This is true both for understanding needs related to particular areas, and for ensuring that policies link up together. Improving decision-makers access to quality, easy to use data, will improve decision-making at all spatial and governmental scales.

Our research 'A Map for England' took English policies with a strong spatial dimension and mapped them to highlight overlaps.[1] It showed that some policies and programmes, when considered against each other in relation to different parts of the country, may have unintended consequences. This clearly highlights the importance of publishing data in with consistent spatial identifiers. In the ideal, all policy should be clearly linked to the spatial area it will influence in order to make overlap obvious. The Geospatial Commission is in a great position to push for this.

Specific data:

Land Registry ownership information is important for planning – therefore we strongly support moves towards completing the registries around the UK and making the data more accessible. It can help local authorities developing plans and assembling sites, for example to deliver new housing. It can also help citizens participate in planning processes. In particular, the National Polygon dataset should be prioritised, along with identifiers (e.g. Land Registry Title Numbers) that would improve linkage with other data.

The Geospatial Commission should also push for data to be collected and made accessible on beneficial owners of land, and options to purchase land. As it stands land options can be registered but do not need to declare that they are contingent on the allocation of land in a plan or the grant of planning permission. They are not required to be registered or disclosed at all. The compulsory registration of such options would assist more effective plan making at all levels and the smoother and more transparent operation of the land market. It would also increase public confidence in the system.

Linking data:

The Geospatial Commission should make linking up data a major priority. As described above, our Map for England project attempted to bypass policy siloes by matching up datasets from different Government departments. This kind of linking of various types of data should be a standard working practice and the Geospatial Commission could help prepare a data infrastructure which makes this easy.

[1] Wong et al. (2012), A Map for England, https://www.rtpi.org.uk/knowledge/policy/map-for-england/

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

No response

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

No response

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No response

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No response

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Our main public data infrastructure should be developed and maintained with public funds to pursue public interests, be they economic, environmental, or social, or to help improve policymaking. This data should then be made as open and accessible as possible.

There are a number of ways in which the land market could be made more effective with new data which could easily be mapped. The organisations involved in the Geospatial Commission should link up with others including the MoD, NHS, and ONS, to collect and publish data on a range of things, including[2]:

- **Comprehensive and transparent ownership data with key identifiers**. This would make it easier for local authorities to develop plans and assemble sites, and for citizens to engage with land use planning. Data on land ownership needs to be available in aggregate and over territories not simply to "purchasers". Understanding concentration of land ownership (and planning permissions) will help understand how to promote competition and diversity in development.
- **Beneficial owners of land, and options to purchase land**. As it stands land options canbe registered but do not need to declare that they are contingent on the allocation of land in a plan or the grant of planning permission. They are not required to be registered or disclosed at all. The compulsory registration of such options would assist more effective plan making at all levels and the smoother and more transparent operation of the land market. It would also increase public confidence in the system.
- **Land prices by site and by hectare**
- **Mapped planning permissions with dates and details** of what the permission is for, who it was given to and the status of the development. This would mean that the spatial impact of housing delivery can be properly monitored. We explored this in our recent research, Location of

[2] See also: KPMG and Shelter, Building the Homes we Need, p.60 https://home.kpmg.com/content/dam/kpmg/pdf/2015/03/building-the-homes-we-need.pdf#page=60

Development, on why housing location is as important as supply.[3] It would also mean that the distribution of permissions could be understood better.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The coverage of high speed broadband must be a priority as it will enable the collection and use of geospatial data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As described above, our main public data infrastructure should be developed and maintained with public funds.

However, the private sector certainly creates data which could contribute to the underpinning data infrastructure. More should be done to encourage private sector companies to share data relating to public spaces and services such as transport. This would be useful to planners seeking to improve urban design.

[3] www.rtpi.org.uk/locationofdevelopment

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Licensing restrictions associated with the use of OS data is often cited by local authorities and other public authorities as a reason they can not release data they collect as open data.

In this and other cases, the Geospatial Commission should seek the minim um amount of restrictions on how datasets can be used and how derived data can be shared.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

No response

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No response

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The Commission should collaborate with various different Government organisations, both to develop this strategy and on an ongoing basis. This might include, for example, the new MHCLG Digital Policy team.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Coordination between local authorities is essential to the digital transformation of planning, and in particular to making planning data more accessible.

We agree with the points made in Owen Boswarva's response[4], around:

- Making greater use of the Single Data List.[5] In particular we would like to see more consistent information collected by local planning authorities (e.g. on resourcing). Though this must be explored with an understanding of the cost of collecting data.
- Government mandating schemas for returns of geospatial and other data from council sources, to ensure consistency and interoperability.
- Replacing PSMA with open licensing of MasterMap data

In 2018 the ODI conducted research into the role open data plays in the delivery of public services. We agree with several of the recommendations from this report, including:

- the need to fund local authorities to experiment with ways of developing new uses for geospatial data
- the need to support collaboration between local authorities, including through supporting peer networks.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

[4] https://www.owenboswarva.com/blog/post-gc2.htm

[5] https://www.gov.uk/government/publications/single-data-list

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We welcome the focuses on property and land. Geospatial data and technologies have the potential to make planning more effective and to free up time for planners to concentrate on pro-active planning.

Q18: Are there any other areas that we should look at as a priority?

No response.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

We are interested in how geospatial data will be involved in the development of autonomous vehicles. Increased use of AVs will require careful input from planners.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

No response

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The US state of Montana provides an example of how information on land can be made accessible to everyone.[6] It is particularly interesting in displaying all land boundaries and land ownership, but also linking this with a wealth of other information (and adding more and more new linked datasets as time goes on). One major advantage is that all the data is linked to properties. For any parcel of land you can easily find out information on a range of metrics including: ● the owner ● the property type ● the land value ● the land use ● the dwellings and other buildings This highlights how valuable a move towards opening up Land Registry Title Numbers and the National Polygon dataset could be. This kind of tool could help make planning, and in particular community participation in planning, more effective in the UK. Given the richness of UK geospatial data, this could easily be a world leading resource.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[6] http://svc.mt.gov/msl/mtcadastral/

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Runnymede Borough Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I believe 'geospatial' and 'positional' are descriptively too similar as they both relate to location. Geospatial could also be described by its data format (i.e GeoJSON, GeoPackage) with 'positional' or 'geospatial linked' data in non spatial formats (i.e Excel, CSV) described as data that has a location element but isn't spatial in its raw form.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

A focus on data sharing, management and web services / platforms is important to provide the best basis for all data owners to publish and centralise information, as well as accessing government / partner data most efficiently. data.gov.uk is a good start but could be improved (i.e encorporating map searching functionality to find data in specific areas).

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

A reliance should be put on geospatial and GIS based learning at the earliest stages of academic studies in schools. As mobile technology evolves, younger generations are growing up with geoinformation and becoming more accustomed to it, perhaps without the knowledge and understanding of what they are using and how powerful it can be. Helping them to understand geospatial early on could lead to improved chances of steering more children into geo based careers.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

It would be of huge benefit to unlock more information from Land Registry's Title polygon dataset in terms of land ownership. As a Local Council we receive frequent queries regarding land ownership, and to be able to interrogate this dataset to identify who's responsibility a piece of land is would be a great time saver to resolve queries at the first point of contact. The existing web service feeds provide boundary information but with no valuable attribute information; this addition would be a significant benefit.

Q5: Do you anticipate that any changes will be needed to both the address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Apart from greater ease of access by opening up address data under the OGL, I don't believe there are any fundamental changes required to satisfy emerging technologies.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

This is an area I do not have knowledge or expertise in and cannot offer a reasonable answer.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

AI appears to be the technology which is leading current research and innovation efforts and would be an area to unlock for potential economic growth exploting geospatial data.

Drone technology for aerial imagery capture could be of significant importance particularly for areas around London and other airport regions which suffer set backs through air traffic control restrictions on conventional aerial flying surveys.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

This is an area I do not have knowledge or expertise in and cannot offer a reasonable answer.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Cuts in funding from central Government have made it harder for local Government to maintain service provision and investment in geospatial technology.
Any national initiatives could require investment through new burden funding much like the INSPIRE Directive to ensure public sector organisations are able to meet and adhere to any Government driven projects.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

This is an area I do not have knowledge or expertise in and cannot offer a reasonable answer.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Critical datasets maintained and developed by the private sector (i.e utility networks) should where possible be available for use for public sector organisations via reasonable licensing agreements to improve the quality of their own data assets and to better inform for the provision of public services.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

I have found the access to geospatial data across the public sector to have significantly improved in recent times, particularly from central public organisations like the Environment Agency via WMS / WFS data feeds and opening up datasets via the OGL. The challenges generally come from local authorities who are at varying stages of meeting the INSPIRE regulations and therefore are offering different levels of geospatial data access. The standards to adhere to are mostly in place, it is more a question of encouraging those organisations to meet the standards, as different levels of willingness / resource availability mean there is still a disparity across the public sector.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Communication is a key element to ensure that public sector organisations make the most use of the datasets available; an improved awareness of what datasets are consumable is imperative. For example the work the APGB has been doing is extremely important and relevant to local Authorities, but the awareness of the web services providing the data may not have been too widespread. Rather than local authorities having to sign up and finding out these services are available, it would be more beneficial to ensure all local authorities have ready to go accounts with direct service links from the start to promote and ensure they are being actively used.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Referring to question 4, a more detailed Land Registry title polygon dataset would find huge benefit in the local authority spectrum. The current web service offerings are of great use, but additional attribute information to include title numbers and land ownership details would be of great use.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

There needs to be a common framework to adhere to in terms of data standards, schemas etc for core information. Ensuring the core aspects of geospatial data are covered, those variations / differences required for specific areas can be satisfied without incurring significant interoperability issues.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Similarly to question 15, a common framework should be agreed upon so that data irrespective of which local authority it comes from will be structured in the same way. The Surrey Digital Services developed a Surrey wide planning hub which took planning information from across the County and published it onto a centralised web application basing it on LGA's planning application schema. Removing physical boundaries from data would improve public service delivery, and working towards a common standard again means that data can be interpreted and used irrespective of where the data resides in the UK.

The establishment of an online community forum specifically for local authority users could be beneficial; the Knowledge Hub does have forums for this but these tend to be found out through word of mouth – active promotion and awareness via the Geospatial Commission could engage more geospatial users around the UK and open up better and more informative discussions online.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

This is an area I do not have knowledge or expertise in and cannot offer a reasonable answer.

Q18: Are there any other areas that we should look at as a priority?

The list appears to cover the key areas for potential economic value utilising geospatial data.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous vehicles and AI / VR are areas that will heavily rely on geospatial data which could pose regulatory challenges as they are new fields of innovation.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Internationally visibility will coincide with partnership working and collaborating with other international organisations on comparable projects. To maintain the standing the UK has in the international geospatial community, we need to continue to work on international programmes to show that we are focused on globally improving the geospatial economy to benefit not only those in the UK but across the World.

In terms of data, the UK's efforts to open up much of our public sector geospatial data must display a desire to share and encourage information to be freely used, and this must continue to ensure the UK's presence as a global leader within the geospatial industry.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Open address data is one area that should be looked at and specifically Denmark appear to have seen significant benefits in opening up their national address database. Addressing has been a long withstanding bone of contention but the benefits that can be realised make it an area to continue to investigate.

Thank you for your time in completing your response to our call for evidence.

1. Is the Geospatial Commission view of the geospatial data types (Geospatial data, Positional data, Geospatial identifiers and Geospatial services) accurate, if not what should be included or excluded from this?

“Geospatial Services” is not really strictly a data type however there are offerings that deliver “data as a service” e.g. through an API. Positional data could be more appropriately labelled as “Ground Truth Data” or “Location Information Data” as positional data terms is generally related to only geographic coordinates of a location.

2. In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus to help ensure the necessary capability within the UK for the future?

The UK has some of the leading researchers in the geospatial domain. However, schemes such as DSA accelerator scheme run by the GDS for general machine learning can be adopted and run specifically for geospatial domain applications.

There is a lack of qualification, understanding and appreciation of geomatics as whole (i.e. art of possible/challenges/capabilities) at SCS and director level in govt. There are many government organisations with enterprise spatial infrastructures containing critical geospatial business data, where the senior leadership would benefit from having greater awareness on geospatial strategy and techniques, innovation and geospatial capabilities. Developing geospatial skills in the directors/SCS cadre should be an area for the Commission to focus on.

The European Commission has the EC Science Hub (Joint Research Centre) which is where the majority of its geospatial science and technical capability sits in the EC. It is the EC’s JRC that has been responsible for introducing Earth Observation into the UK and the agriculture policy over the past 20yrs, long before Defra had an Earth Observation Centre of Excellence or UK establishing its own space agency. When we leave Europe, the UK won’t have the JRC and its capabilities, therefore the Commission should consider setting one up in the UK to fill the gap.

3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Recruitment of geospatial practitioners in government is difficult. GRS and gov HR departments don’t fully recognise and understand the profession yet. We are unable to attract middle managers from the private sector (in to the GI profession) into government. Despite many UK universities offering geospatial courses, we don’t attract applicants that have studied at UK universities, which suggests that government recruitment of UK graduates isn’t working. E.g. Fast Stream at Careers Fairs is attracting generalists not geographers.

The gap or challenge is finding people at HEO/SEO that have been in geospatial technical roles and can work with the GI data and technology, but also have managerial/leadership,

business delivery /analysis skills and competencies. All too often, an appointed GI analyst nearly always remains a GIS analyst, whereas they could progress on to more senior roles in GI Architecture, GI Business Analyst, Data Scientist or Manager etc. So the career pathway beyond GI Analyst should be an area of focus.

4. How should the Geospatial Commission prioritise which geospatial datasets they target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

The rural land parcel data (digital map of agricultural land) that is created and maintained by RPA/Defra is a key asset that is under-exploited. It is tightly coupled to Ordnance Survey Mastermap and thus subject to PSMA rules and restrictions. It is used extensively across the public sector (central and local govt), but not much in the private sector. By making the rural land parcel data open will enable the agricultural industry and agri-tech sector to exploit the data. For example, farmers will be able to us the data in their day to day business with farm management software and in precision farming.

At the RPA, we have often felt that the lack of regular supply of “Ground Truth Data”, (referred as “Positional Data” in the document) limits the UK’s ability to undertake national remote sensing campaigns, produce classification products or maintain a continuous monitoring regime of urban and agricultural geography. We also regularly receive FOI requests by private sector organisations, universities, research institutes to ask for the data that the RPA has collected from its inspections. Equally, there are other organisations across the Defra group and other organisations who also collect ground truths. The answer is a coordinated “National Ground Truth Layer Service” capture programme could be established with help from the Commission, outputs of which can be made available to everyone, particularly the private sector who want to develop earth observation data products but can’t because the ground truth data is not accessible.

5. Do you anticipate that any changes will be needed to both address data and the wider address ecosystem to support emerging technologies? Please provide evidence of value to support any proposed changes.

We speculate that robust data quality checks and collection techniques would be critical for some of the emerging technologies. For example, there is occasionally news of vehicles stuck in narrow lanes because the sat nav is not fully aware of the local road environments. Such mishaps can be avoided by careful collection and use of local context.

6. How should the Commission be looking to develop the UK’s capability in Earth Observation data, both technologically and to support an effective market?

The UK has a reasonable coverage of the downstream EO data market so the deployment or joint-ownership of our own satellites i.e. upstream sector would significantly boost the UK’s capability to provide bespoke EO data services.

Secondly, the military and national security sector possess technologies and capabilities that would benefit the civilian sector if there better collaboration. Releasing some of this

capability and innovation, or the military sharing some of its best practice would help the civilian sector overcome some of it challenges.

7. Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission has already identified mobile positioning technologies, and geodetic networks, which in our view is relevant for a wide variety of application areas.

8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Use of geospatial data and applications could be used to model the scope and impact of the future technologies. For example, information on road networks can be used to model the impact and feasibility of (semi) autonomous vehicles.

9. What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The requirement to comply with mapping guidance (for Common Agricultural Policy) by the European Commission has driven RPA/Defra to maintain a very high quality asset and capturing process of geospatial datasets. Given that the new agricultural policy post Brexit and ministerial desires are to move UK away from extensive use of geospatial data and technology to maintain mapping on a national scale, RPA/Defra would lose the incentive to maintain and enhance the rich geospatial datasets (i.e. hedge data, land data, crop data, common data) on a national level. Therefore, a similar incentive would have to be set up, preferably linked with some subsidy scheme for added regulatory dependency.

Conversely the rest of Europe is going in different direction for Agriculture, whereby other member states are moving to a full satellite based monitoring regime that will remove the need for on the ground farm inspectors. If England adopts an agriculture policy that is so environmental and less agricultural that doesn't allow for the use of geospatial technology and remote sensing inspections, then UK farmers will be disadvantaged and subject to more red than their European counterparts. In the interest of the food and agriculture industry, the Commission should influence the Agriculture policy making to ensure that UK does not regress back to the beginning of the 1990's before we started using geospatial for Agriculture and Food policy.

10. What areas of the underpinning geospatial infrastructure such as positioning technologies (including GPS and indoor positioning systems) and geodetic networks and frameworks to support them should the Geospatial Commission prioritise the development of to support the emerging requirements for geospatial data?

The Dutch Agriculture industry is the exemplar when it comes to geospatial infrastructure. The Dutch farmers are using more precision farming and remote guidance tractors because they have a more complete and better RTK GNSS/GPS network. The UK doesn't have a common standard and open base-station RTK network, which deters precision and

smart farming. Farmers have to buy their own base station or subscribe to one (if there is one available nearby).

Also, the agriculture industry wrestles with different manufacturers' using different GPS standards. For example, an RTK network for Trimble GPS doesn't work with John Deere or Topcon products. If the agriculture industry is to move forward in the digital era, there needs to be some harmonisation of standards. Imagine if you bought a second hand car and its sat nav didn't work because the previous owner subscribed to or lived in an area that received a different signal.

11. What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

As described above, the private sector (machinery manufacturers RTK signal providers) could all adopt the same standards. Remove the 'VHS versus Betamax' scenario.

Private sectors could work with each other to ensure that the capture plan for their products complement thus ensuring the data quality is consistent, and provide robust , multi-modal and scalable distribution of the geospatial products .

12. Do you face challenges when working with geospatial data from across the public sector, and if so what are they, and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The RPA is required to maintain the mapping of land parcels up to date, and none of the mapping is expected to be based on information (e.g. OS MasterMap, APGB Aerial Photograph) older than 3 years old. Therefore, the knowledge of currency e.g., the aerial photograph capture date or the field survey date that underlies some of the public sector data e.g. OS MasterMap and APGB Aerial Photographs is very important to the RPA operational business processes for surveillance GI data maintenance. However, these organisations run their data capture campaigns independently, even though in some cases they are linked to each other. It would be useful if the respective organisations can harmonise the data collection such that they complement each other. For example, OS, APGP, and EA all keep their planes in the same hanger at the same airport. Despite being in the same hanger, all three planes (funded by UK govt) have their own flight plans that are not aligned in any way. If they were aligned, the currency could be reduced down to 1.5yrs-2yrs.

13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The commission could conduct a wide survey of geospatial needs for public sector and identify overlaps and scope for enhancements in the quality of geospatial data currently procured by the public sector.

14. Are there any additional geospatial datasets, from the other Partner Bodies or other sources that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There is probably a vast amount of socio-economic, infrastructure and planning data that is maintained by the public sector organisation but it is unavailable for various reasons. There have been several projects in the past regarding data discovery portals could be set up e.g. through data.gov.uk

15. How can the Geospatial Commission best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

There could be little value to be gained by attempting to build a so-called single UK strategy because national variations may inhibit adoption of such a policy. For example, the Agriculture and Environment sector is a large geospatial use case that is already devolved and adopting different strategies.

Conversely, when we leave Europe, will a replacement INSPIRE be required, or will we continue to adopt the principles of INSPIRE in the UK? Eitherway, this is where a strategy might be useful to replace previous EC strategy and policy such as INSPIRE.

16. How can the Geospatial Commission best ensure effective local authority co-ordination and sharing of best practice, using location data to better deliver public services?

The inclusion of local authorities within the APGB framework is a good start. The planning permissions department of local authorities could be asked to enrol in a centrally run government mapping platform (e.g. one baselined against the MasterMap or Land Registry), and made available to the public.

Going forward, there are some other member states that have adopted an Open Street map /Wikipedia approach to national mapping. UK could appoint a central statutory coordination unit to oversee the administration of standards policies to be used in updating Mastermap. Devolve the update of Mastermap to the multiple public sector mapping teams across government, e.g. HMLR, EA, Councils, RPA, FC, etc. With governance, standards and SLA's in place, multiple different bodies could be authorised to update an open Mastermap, like Wikipedia or Open Streetmap.

17. As a result of analysis the Geospatial Commission are prioritising the exploration of possible initiatives in the high-value categories identified (property and land, infrastructure and construction, mobility, natural resources, sales and marketing). What are the existing or potential geospatial applications which could be scaled up or developed in order to capture economic value?

The following suggestion doesn't necessarily create new value but can potentially offer significant cost-savings and generate information that would be useful for policy. Much of

the property related information available online doesn't reveal information such as age and details of the property (e.g. conditions etc.). Providing these information would unlock opportunities for policy makers and private companies to assess areas of regeneration or potential hazards e.g. poor building materials (like fire resistant cladding). Similarly, there is lack of information on the quality and design of infrastructure such as highways in a format that can be publicly available e.g. equivalent of google streetview.

18. Are there any other areas that they should look at as a priority?

NO

19. What are the main potential private and public sector innovations that will rely on the use of geospatial data to roll out, and are there corresponding regulatory challenges?

(Semi) Autonomous cars, AI driven internet search queries that use a geographical context (e.g. about traffic, weather, shopping etc.). There would be no new regulatory challenges and existing mechanisms such as GDPR, IPR and others would address privacy concerns.

20. How best can the Geospatial Commission make the UK's presence in the international geospatial world more visible?

At present, the UK's presence in the international geospatial world mainly comprises of academics and commercial organisations with an international outreach e.g. the Ordnance Survey. This has been possible because of existing international collaboration programmes and fellowships. However, there is a vast amount of commercially valuable ideas being developed, and geospatial expertise available within the government departments and public sector organisations. These organisations do not have the opportunity to expose their work internationally. Geospatial Commission should look into setting up international knowledge and expertise exchange programmes at government levels and funding mechanisms for experts to participate in international events. This will be particularly relevant post-March 2018 when such existing mechanisms with EU will be unclear.

21. Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

As mentioned earlier, the Dutch are considered exemplars for Agriculture and Agri-tech that use geomatics.

While, the geospatial data, software, and hardware domains are fairly stratified and comprises of a pre-existing heavy weights who dominate in the respective fields. For example, from the USA, ESRI, DigitalGlobe, and other small companies have the largest share of geospatial, and very high resolution satellite images market, while from Switzerland and Germany, Leica and others have the largest share of survey instruments and software. In others word, the other countries have focussed on a specific domain of the geospatial ecosystem and invested heavily into it. The geospatial services industry is

however quite fragmented and contains abundant opportunities for UK start-ups, franchises across the world.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Sainsbury's Supermarkets Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted] [Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	

Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

This is broadly a good view of geospatial data types, assuming that 'geospatial services' consist of augmented data products, such as geodemographic classifications and census information. We would encourage the inclusion of (spatio-) temporal data. Using additional examples for clarity would also be beneficial as it is easy to confuse Geospatial Data and Positional Data at present. For example, we take Geospatial Identifiers to include addressing, postcodes and Output Area Boundary codes. We take positional data to be the location of a store or asset. These elements would benefit from having a more constrained definition (especially geospatial identifiers).

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Improvement in geospatial skills comes from two main areas. Firstly, training in schools and universities. We believe geospatial should be a core part of non-geography degrees (computer and data sciences, as well as other social sciences). This could and should start further down the levels of education. There is also scope for re-introducing geospatial data and analysis to many qualitative geographers. Many of these techniques should include basic skills with linking geospatial data and positional data and then using visualisation tools to analyse, present and create products from these data sets.

Away from university, there is a huge gap in widening awareness of spatial and the benefits that it can bring within business and other organisations. Very few people understand even basic information such as being able to see an organisations' assets on a map. There are many relevant use cases that are not yet exploited or advertised, and promoting how geospatial can add value to organisations should be more widely promoted, particularly with reference to applications and the types of decisions that are not possible without geospatial data and techniques. This is not geospatial skills training per se, but a wider education for understanding the applications. There is also perhaps a gap in non-spatially trained professionals with regards to the collection and recording of spatial data, but this might not be the best use of the Commission's resources and may be better placed within organisations on specific projects.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The largest gaps lie in growing an organisation's understanding of where their assets are and the types of interaction customers and people have with the services provided. In our experience, there is a large gap within the IT/BI sector where geospatial knowledge can be limited. This gap is also relevant amongst the business analyst community whose focus tends to be on what happens within a store (or other asset) and not on the changes and real world behaviours outside it. These two areas – almost an introduction to GIS – would be a good focus of the wider acknowledgement of the industry.

Within those who have some knowledge of the industry, are skilled or partially skilled, there is a very broad range of expertise and sector knowledge. It is hard to apply training for general geospatial skills (e.g. remote sensing is a very different skill set to spatial interaction modelling). There is good provision for both core skills and more technical skills from a variety of vendors and educators (for example GIS BSc/MSc's), however the industry might benefit from a series of MOOCs more tailored to specific subject matters (for example, there are many MOOCs on Data Science on the various platforms (edx, coursera, udacity), but few on Geospatial).

An understanding of ethics and privacy, and the challenges when adding a spatial element to data, can also be overlooked. There are many big questions that are yet to be answered here, for example, just because we can track someone's movements through mobile phone data, should we? Do we all know that around four timestamped locations can lead to identification of a person? How can we reconcile this with needing to innovate? Accordingly, there could be training in this area, as well as publishing of geospatial datasets to a non-disclosive standard. This is an area that the national statistics bodies have great experience of but is rather limited outside. Increased levels of awareness and understanding of how open data can be published in this area and then catalogued and understood for the creation of value is important. This includes all aspects from a basic legal understanding of creative commons to technical mechanisms for accessing data sets.

There is often a large gap when it comes to telling stories with maps, and even when spatial analysis forms part of a project, the exclusion of spatial story telling is often found in presenting results. This skill set might also go some way to helping the exposure of geospatial analysis.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- Addressing and UPRNs (discussed in more detail later).
- Issues related to devolved and local governments (again discussed later).
- Wide (cost effective / free) access to OS Mastermap (Inc NI), which prevents full adoption of GeoBIM.
- Ratings Lists by Country.
- Access to Novel Data Sources (Card Data, Mobile Phones) are prohibitively expensive on a large, UK wide-scale. These behavioural geographies would be hugely beneficial for a wide range of applications if made more easily accessible.
- Clean and easily consumable open data such as GP-Pharmacy Prescribing Data (inconsistencies between reference files), Consistent Train, Tube, Light Rail Station locations and Passenger counts (e.g. some miss a spatial reference for a station).
- Land Registry Polygons linked to UPRN.
- POI data for GB and NI in a consistent format.
- Aggregated but spatially referenced data from HMRC.
- Urbanity at Local Authority Level for the whole UK.
- A nationally sourced and provided drive time/travel time network, which is able to provide a consistent view of the time it takes to get from one place to another. This would combine the ITN, Average Speeds from actual journeys, as well as pedestrian routing. Cost of entry can prevent a

consistent source being used (and therefore different results) and has many applications within transport, retail, health and beyond.

The majority of these datasets are in existence, but are prohibitively expensive (or bureaucratic) to access from a license perspective (and occasionally but not always a processing perspective).

We should also recognise some of the great work being done to simplify data access by both the ONS Geography Portal and Research organisations, such as the Consumer Data Research Centre.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

A primary focus should be on establishing an open and complete form of spatial addressing dataset, including land reg polygons, UPRNs, grid refs, and any other related linking fields. This will enable organisations to maximise the spatial accuracy of both asset registers and also help service delivery. For example, no more missed deliveries due to erroneous locations or sat nav locations. A single consistent framework for this would be hugely beneficial.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

EO data has many potential benefits, which are often overlooked due to the overhead of processing and maintaining the data which is resource heavy and often duplicated across multiple organisations. Providing pre-processed data sets (perhaps cloud hosted) containing indexes against which particular data sets can be identified, publishing this data in an effective and easy to consume manner could help to open up applications such as:

- AI questions – field boundaries could be mapped and visualised in terms of the change through time and the impact on local communities.
- Deforestation – this is a key sustainability concern and relates to SDG 15. The ability to monitor deforestation to ensure that we are sourcing sustainably is key. This can track progress and indeed progress on tree planting as well as deforestation to ensure total impact can be quantified.
- Fishing – using data to monitor locations and routes of vessels is an important tool to ensure that supply chains are legally compliant.
- Asparagus shipping – tracking container vessels and internal data from these containers has enabled us to move products from air freight to sea freight meaning more efficient and sustainable transport. More value can be unlocked through this. It allows the supply chain to plan better and reduce food waste.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Develop a standardised way of finding places in real life. This would include all addressing items in Q5, perhaps with more precision, such as what floor of an apartment block an address is located on (helping service delivery in all sectors from retail to health and emergency services).

The creation of a (single) portal to access or redirect users to all data would be hugely beneficial (discussed more later). Alongside this would be a set of standards and indexing for ease of search and better traceability back to original sources of data.

From a practical perspective, improvements would also be gained by contributing to some of the technologies (e.g. open software, open geospatial consortium) to improve ease of use, spatial data storage, better traceability, spatial algorithms (e.g. more efficient spatial matching etc.).

Emerging technologies such as sensor tracking, tracking of goods, traceability of products would be another useful area of focus. For example, could there be a global traceability system for efficiency in food and goods. The efficient combination of sensors and geospatial data would have applications in ecosystem mapping, pollution prevention and conservation, and current technologies have a relatively high entry cost with a need for many specialists.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Everything that happens, happens somewhere. The integration of standardised addressing into future technologies (as discussed previously) will help solve many issues. Geospatial also has a role to play in the localised roll-outs of new technology from a logistical/organisational perspective, as well as supporting in the ongoing management and maintenance (and gradual improvement of) existing technology.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The centralising of (or centralising access to) data could be invested in or maintained by small charges to those who make planning applications. For example, the digitising of new roads by the OS could be funded in part by those building those roads.

There is also a role for policy enforcement (and fines), which geospatial be potentially be used for.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

One area could be LIDAR data, making sure that this is more precise, more frequently updated, more open and easier to use. Pre-processing and packaging in a useable format is key. The history that a long term data set would create will be useful for understanding change in environment in a range of domains, such as building management, planning, and agriculture. GPS, in our view is relatively established and sufficiently accurate for most of our applications. IPS, and the multitude of approaches, has a relatively limited range of applications, but efforts could be made on the interlinking of GPS and IPS.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Most organisations should be able to easily develop asset registers (e.g. Store A is located here). There is no reason why information about such assets should not be shared with UPRNs to help other conduct analysis of what is where. There may also be a role to play for the private sector for supporting geospatial data and analysis for the public good, however this can be challenging from a resource perspective, as well as a host of issues related to coverage, bias, and representation within private sector data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

One of the main issues we face is that of devolved governmental data. This manifests itself in a variety of issues such as different methods, different formats, different levels of spatial coverage, and different release dates. For example, the staggered release of census data from each nation (especially with latterly released products such as workplace zones) remains problematic. Whilst we do not expect all data to be the same (nor is this the best use of efforts in the short term), consistency of release dates would be valued. More importantly, ease of access (a single point) and clarity of the most up to date data would be beneficial. Data formats are largely workable, for those with the right tools and knowledge, but this is not the case for all users and could be a limiting factor.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We agree with the aims stated above. The effective procurement and simplification of this range of spatial data will be key to efficiencies across the public sector. Thought could be given to whether some of these also be used amongst the private sector, who face similar issues to the public sector. Many organisations are buying the same data from many different suppliers.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Geotemporal Payment Card Data – for use in economic statistics – where and when is economic activity growing and shrinking? The ONS are working towards elements of this from large retail organisations, but some more detailed geospatial measures may be obtainable from banks and card operators.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Create as many common standards as possible with regards to data formats, timescales of release, coverage scales/geographies. However, the most useful development will be a single portal. Where data are readily combinable (e.g. collected to same specification), combine it. Where not, send the user to the respective datasets. Reducing the hours spent trawling each stats office website will be very valuable.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

An area that would provide large improvements would be the co-ordination of the planning system, being able to more easily track planning applications accross multiple local authorities.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**

- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Many of these use cases offer large potential value to both business and the wider public. Within the property and land category, the opening up of an easy and free to use property search function (ownership, planning, flood etc.) under the guise of e-conveyancing has the potential to create considerable savings in house and property purchases, both monetary and the time taken to complete purchases. We can also see value in supporting optimal routing for utilities.

Some particular use cases, and potential projects, that it would be good to focus on within the themes above would be:

- Construction project timelines and land registry completion data, which would help to establish when new housing developments are complete and occupied, including estimating how many new homes are occupied at different stages of the development. This would be particularly useful for planning services, from both a retail perspective and health, schools, etc.

- Within this domain, increasing GeoBIM adoption will help with better planning and design of new buildings. Their setting within the environment will benefit public consultations and the planning process and may also create efficiencies in preparatory work stages.

- Mapping of end-to-end supply chains and the tracing of products through the supply chain is already done in some sectors, but innovations might be gained through the examination of new technologies such as block chain and RFID tagging. A worldwide geocoder could be an important part of this. Better understanding the full extent of global food production will become increasingly important with climate change from both a policy and practical perspective.

- There is large potential within the optimisation of deliveries using a combination of both better and more open addressing and more effective and accurate journey time networks. Better understanding of journey times (through more accurate/real data and better route planning at complex junctions) will help to better plan deliveries, including optimising staffing levels and delivery slot availability for consumers. Open addressing is obviously a key part of this.

- Precision Agriculture – this is currently undertaken well with machinery but there are vast areas of improvements for application technology and combining multiple data sets. For example, crop development/quality with field boundaries and tractor movement. There are also multiple uses in

enforcement of regulation that is currently in its infancy.

Many of these use cases are very possible but are limited by the prohibitive costs of entry at large scales.

Q18: Are there any other areas that we should look at as a priority?

- Health (e.g. access to services; location of services; health outcomes)
- Transport network (spatio-temporal datsets on commuting and congestion)
- Energy efficiency (e.g. small area household energy consumption)
- Regulation and Equity (e.g. small area energy tarrif / switching)
- Regional Economies and Resilience (non-disclosive HMRC indicators of activity)
- Property & Land (vacant / brownfield land register, Local Plans housing register)
- Tourism
- Climate change

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- GeoBIM will require access to high-precision map feature data so that buildings may be placed accurately in their environment e.g. open access to OS Mastermap and/or Land Registry Polygons. The current charging model for OS and Land Registry data is likely to inhibit the widespread uptake of GeoBIM.
- Addressing and ease of finding places will require an Open Address Register which brings together address, position and related spatial references (e.g. UPNR). The current situation between Local Authorities, Ordnance Survey and Royal Mail stifles innovation in this sector.
- Agriculture – precision agriculture, driverless farming, satellite imagery and linkage to farm payments post Brexit, also potential to use to enforce regulation.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- Creation of an international intergovernmental conference on geospatial innovation and standards.
- Setup a new division in ONS dedicated to Geospatial Statistics. This could be used as an exemplar internationally.
- Setup/fund/support interenational disaster response charities (e.g. from international development fund) such as MapAction, CrowdResuce, Humanitarian Open Street Map, Red Cross etc.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

We believe that the UK should be seen as an exemplar on internationally recognised standards, and this may be something to work with the BSI, ISO etc. We have limited experience of working with international geospatial data commissions, although some experience of working with international data. From the perspective of data access, the INSPIRE portal, ONS Geography Portal and Irish geoportal are all easy to use and find data, as are some of the off-shoots of the UK big data research network, but links away from these locations can sometimes be problematic. From the perspective of raising awareness, much of the best work that we have seen comes from the private sector, often large or SME geospatial companies such as ESRI, Carto and Stamen who present applications (albeit from a promotional perspective). We have limited experience of large agencies trying to bring together a wide variety of partners and facilitate innovation in the space.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Satellite Applications Catapult
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	**X**
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	Independent non-profit technology innovation company.

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We support the categories and descriptions captured with the following considerations:

- **Presentation in the current format is an oversimplification** due to the non-linear nature of adding value to geospatial datasets. A geospatial 'product' can simultaneously belong to multiple of the described data types depending upon user case and application.
- **Temporality** is an unavoidable perspective that doesn't seem to be considered within the definitions and is integral to any geospatial data type.
- **Earth Observation** image (raster) datasets are assumed to have been considered within the definition and fall across the geospatial types depending upon their user case.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The skills and technologies noted below are in high demand across the UK public and private geospatial sector.

Those in bold should be considered priority areas for policy intervention and investment.

- **Sensor Interoperability, Harmonisation and Data Fusion**
- **Geospatial Database management**
- **Business-led deployment of Deep Learning techniques (Convolutional & Recurrent Neural Networks) upon Geospatial Data.**
- **Workflow optimisation (Scaling and Clustering)**
- Building Information Modelling (BIM)
- Market (user case)-driven Earth Observation application development.
- Geospatial Intelligence Provenance: Uncertainty Modelling and Error Propagation

- Statistical Modelling and Inference
- Feature Extraction, Object Detection and Classification upon Geospatial Data.
- 3D Geospatial Information Systems
- Geospatial-driven Augmented and Virtual Reality
- Geospatial standards (OGC, etc.)
- Cross-platform Infrastructure Deployment (Virtualisation and Cloud)
- User Centred Design
- Open Data, Semantic Web
- AI-assisted Crowdsourcing
- Open Source, community-driven Software Development (i.e. FOSS4G)
- IoT Exploitation and System Integration

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Ensuring that we proactively identify skills needs is something the Satellite Applications Catapult is ideally placed to achieve through its existing Partnership and Engagement team.

We combine use of permanent staff with building consortia as we have a need for representation of the full breadth of geospatial skills and competencies. Through our engagements over the past five years with more than 3000 organisations, there are recurring geospatial skills gaps that we actively work to address in collaboration with UK partners.

Geospatial-related roles that Satellite Applications Catapult and its wider partner ecosystem persistently struggle to recruit for include:

- **Geospatial and Earth Observation Specialists** with a core blend of geospatial, Earth Observation and Physics expertise for development of geospatial applications.
- **Computer Scientists** with core programming and big data management expertise, limited (but recognised) generalist geospatial expertise, and limited focus on geospatial applications.
- **Research Scientists** with core big data analytics expertise, particularly in design, development and deployment of contemporary machine learning and artificial intelligence, and limited generalist geospatial expertise, with a focus on efficiently evaluating and constraining product-related research questions.
- **Research Engineers** with a core blend of predominately big data management expertise and lesser machine learning and artificial intelligence expertise, with a focus on operationalising the delivery of researched products.
- **Product Managers** with sufficient blend of technical geospatial and non-geospatial market (user case) expertise to provide clarity and direction in translation of geospatial products and services into non-geospatial sector value propositions.

There is simply an insufficient number of people in the system with competencies across these geospatial roles. This current state is detrimental to UK innovation, competition and sustained economic growth. Sustained confidence in the UK geospatial skills base is highly uncertain in a post-Brexit environment.

Availability of skills associated with Research Scientist and Research Engineer roles are most scarce and therefore costly. Commercial advantages in leveraging these skills are limited to only large organisations that can subsidise their cost with existing profits or start-ups offering alternative incentives.

As all organisations face unprecedented data abundance challenges, there is an increasing requirement for geospatial to anchor the value and relevance of data as it is refined into information products.

Geospatial principles must be properly embedded into public and private sector organisations' product development and service delivery teams to improve service efficiencies and sustainable growth.

Addressing these skills gaps requires approaches that consider both geospatial and non-geospatial perspectives across the full career-cycle.

Satellite Applications Catapult, led through its Partnerships and Engagement Team, is a leading protagonist in use of established public and private sector mechanisms to address these challenges and promote careers in the geospatial sector; i.e.:

- Space for Smarter Government Programme (SSGP)
- 18 STEM ambassadors at Satellite Applications Catapult, though nationally many Primes support and encourage their staff to undertake these roles
- Annual and Summer Space Placements in INdustry scheme, 150 students placed in space businesses over 6 years.
- Researchers in Residence (RiR), Future Leadership Fellows (FLF), and Centres for Doctoral Training (CDTs), etc.
- Apprenticeships
- Satellites 101 training courses for cohorts of PhD students
- Supervision of numerous PhD, MSc, BSc students, including across government and industry.
- Charterships encouraging for industry-focussed progress recognition in later career stages
- Satellite Applications Catapult-led training courses for industry, gov., academia in priority areas (i.e. Sentinel-1 course, AI/Deep Learning course).
- Profiles of staff in Geospatial roles to inspire students.
- Hosting stands at national events such as New Scientist Live to promote geospatial careers.

Existing mechanisms alone are insufficient for addressing the specific skills gaps within the geospatial sector. These mechanisms provide only general frameworks, with no geospatial-specific skills development. They also only address skills gaps at an individual organisation, research group, student or employee level. Their exploitation requires overhead investment per organisation in engaging with the relevant initiatives to be beneficial. Each individual organisation must also have clarity in the skill gaps they are addressing. Organisations we see most experiencing skills shortages cannot afford to invest in these overheads.

A coordinated top-down approach across the whole of the UK should focus on priority skills that are lacking across the sector. This would greatly improve the effectiveness of addressing specific skill gaps and support per-organisation use of the existing mechanisms.

The Geospatial Commission is well placed to champion this type of approach. The coordination and implementation must come from other organisations such as Satellite Applications Catapult and UK Space Agency's (UKSA) Skills team.

A primary blocker to inspiring pursuit of a career in the geospatial sector is the disconnect between applications and techniques demonstrated / discussed within higher education and universities and those being operationalised within companies and public-sector services.

A further key challenge is that a career in the geospatial sector is miss-perceived as solely science focussed as opposed to offering equal (if not more!) market-facing career development opportunities.

Access to leading real-world examples throughout education would help to captivate the next generation of geospatial application developers and ensure that they obtain skills aligned with the requirements of leading public and private sector organisations.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

This differs in wording from Q4 in supporting Geospatial Commission Consultation document. Our response addresses both questions.

Q4 (pdf) How should we prioritise which geospatial datasets we target to increase access? Please provide evidence of why this would be of value, and how access or quality could be improved?

We suggest not to prioritise individual datasets but to focus on user-driven impact that can be evidenced through demonstrating the value of contemporary data access protocols.

The Commission can then focus on the much more pertinent question of which user-driven applications require minimal investment to evidence the necessary value to support policy intervention.

Satellite Applications Catapult and the organisations we work with share challenges in accessing geospatial datasets that we expect are common many responses, including:

- Duplicative and disparate sources for individual datasets
- Lack of 'discoverability'
- Spatial and temporal inconsistencies
- Limited or entirely absent metadata
- Inefficient file formatting

When delivering user-driven applications reliant upon Earth Observation datasets a similar set of even more potent 'big data' challenges must be addressed:

- Volume: satellite Earth Observation alone is the 3rd largest global data source.
- Veracity: complex quantitative measures with estimated uncertainty.
- Variety: wide ranging sensor types, platforms and measurements and even greater variety in providers.
- Velocity: sub-hourly and near-real time data streams.

These challenges are most pertinent when accessing public-sector datasets and we must overcome these to exploit ancillary geospatial datasets that are integral to realising value from satellite technology sources.

Specific examples of datasets with which we experience these geospatial challenges include**:**

- Copernicus Satellite Datasets (i.e. Sentinel-1, Sentinel-2)
- Government and Agency procured Aerial Photography
- Government and Agency procured Satellite Datasets
- OS Mastermap (and other products)

- Address Databases (i.e. revenue share across Royal Mail, OS)
- Environment Agency LiDAR
- UK Land Parcel Information System (LPIS)
- Land Registry Polygons
- Metrological Datasets
- Hydrological Datasets

Across the above examples and all other public-private geospatial datasets, **significant value would be gained from** the ability to access these datasets via a mechanism(s) that offers:

- Centralised Data Discovery
- Enhanced Search Capabilities
- Application Programming Interface (API) Access
- Real Time Updating and Live Streams
- Costing Models (i.e. Revenue Share, Pay-per-Use)
- Traceability and Provenance

This value would be realised as, for example:

- **Reduced development costs** (software engineering) associated with gaining data access from multiple access portals and API formats
- **Reduced maintenance costs** associated with hosting duplicative data access portal services
- **Reduced storage costs** associated with uncoordinated duplicative datasets
- **Improvement of existing value-added service**s (public and private sector)
- **Creation of novel value-added services** (public and private sector)

Work undertaken by organisations such as the Environment Agency, Office for National Statistics, Ordnance Survey and others, in simplifying and opening access to their geospatial datasets are recognised steps in the right direction.

Similarly, at the intersection of public-private-sectors, ad-hoc investments into initiatives such as Satellite Applications Catapult's SEDAS and Data Discovery Hub portals are additional steps in the right direction. With further coordinated investment with a long-term outlook they can provide a core and robust bridge for geospatial discovery and access to UK public-private geospatial datasets.

Progress however remains slow, uncoordinated, under-resourced and not resilient to technological change.

The Industrial Strategy Challenge Fund (ISCF) 'Space Data Revolution' Challenge provides a good example of where coordination across public and private sectors leads to a proposal that has potential to create a step change within the UK toward realising the economic benefits from fully exploiting Earth Observation capabilities, by allowing user-driven applications to be developed more easily by more organisations without the need for specialised expertise. **This is precisely the kind of initiative that we expect the Commission to be championing into government.**

Our response to Q12 covers in greater detail the value to be gained from addressing these challenges specifically in the public-sector and in Q11 we give examples of private-sector's involvement.

Assessing the 'quality' of geospatial datasets is highly subjective. It can cover everything from satisfying meticulous metadata requirements and giving complete geographic or temporal coverage, to geospatial attributes being representative, accurate or precise.

In our experience, the most critical component to geospatial data quality is having confidence in the provenance of those data.

The advantages of rich metadata are only realised when the economic benefits of accessing others' metadata rich products outweigh the overhead of maintaining the provenance of your own product metadata.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We expect other organisations to provide much more detailed contributions on this topic but provide the following considerations.

Access to Address Databases of the highest available precision and accuracy (i.e. via Royal Mail, OS) is incredibly challenging. Improving access to these, particularly with regular and complete updates and refined cost-models, would greatly improve location-based services and associated user-drive applications. It would also enable satellite and Earth Observation products to deliver more focussed and greater value in sectors (i.e. insurance) where precise geo-coding is an essential level of product granularity.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Commission should look to champion development of the UK's Earth Observation capability with a focus on user-driven <u>exploitation</u> of Earth Observation data *rather than generation of the data itself.*

The Commission should, however, remain well informed on relevant upstream technological developments and associated programmes, including: UK Launch, high-altitude pseudo satellites (HAPs), UK's in orbit demonstration (IOD) programme, and European Programmes such as European Space Agency's (ESA) In-Cubed programme.

Our response addresses opportunities for the Commission to support development of UK Earth Observation capability specifically within the public sector and then the wider public-private sector.

Specific to the public-sector

There is an immediate need for the Commission to play a coordinating role on behalf of the public-sector to accelerate the realising of benefits from exploiting Earth Observation capabilities across government. This coordinating role should focus on four key areas.

- **Centralised procurement of Earth Observation datasets**. There is a severe lack of coordination in the procurement of Earth Observation datasets, whether archive or tasking of satellite imagery, aerial and drone image or LiDAR acquisition. OPEX savings would be made from optimisation of data acquisition strategies and associated services. Most notably however would be immediate CAPEX savings made from:
    - Preventing duplicative data purchase.
    - Receiving significant discount due to data volume requirements.
    - Greater competition from data providers.
- **Effective dissemination of procured Earth Observation datasets**. Datasets procured for one government department must be readily accessible by all government departments. Centralised procurement would ensure data licensing is fit for purpose.
- **Transparency in Product requirements, not Department requirements**. Requirements for either data or services procurement should be collated at the Product level as opposed to stakeholder level with transparency in the services with which they are associated. This allows Data or Service providers to be realistic in their ability to

meet requirements. It is enabled by coordinated data procurement shifting government's position to a fully informed, empowered stakeholder.

- **Re-evaluation of Government's role as a Customer of Earth Observation services.** The Commission is positioned to coordinate a transitioning of the public-sector's role from being thought of as a customer of Earth Observation data and service providers, to playing an integral role within the Earth Observation value added services market. Government would consequentially enable, and financially benefit itself from, market growth. We evidence this further in Q14 for the overall geospatial sector.

Numerous government-led programmes have started to explore the benefits in exploiting Earth Observation capabilities across government. For example, UKSA's Space for Smarter Government (SSGP) Programme, Defra's Earth Observation Demonstration and Integration Pilot (EODIP) initiative, and the Cross-Whitehall Earth Observation Working Group.

Satellite Applications Catapult has been involved across these initiatives and while largely successful, a compelling case can be made for these not having gone far enough. We recommend that **government should move beyond ad-hoc isolated demonstrators and pilots**. Emphasis should be placed on long-term investments into initiatives that do not consider Earth Observation capabilities independently but as an integral component to operational service delivery.

Across public-private sectors

The fragmented and rapidly evolving UK landscape requires clear direction and focus. Clearer rules for engagement and decision-making responsibilities should be defined across the complex stakeholder landscape.

A definite role for the Commission is to help coordinate and champion into government industry-led initiatives that enable UK to take the necessary steps to overcome barriers to exploiting Earth Observation capabilities.

Initiatives such as Satellite Applications Catapult's SEDAS and Data Discovery Hub portals and CEMS cloud computing infrastructure, as well as the Centre for Environmental Data Archive (CEDA), have taken clear steps in the right direction. While funding for these initiatives has been insufficient to realise their full impact, they irrefutably demonstrated the need for and value in single-point discovery and access to geospatial datasets. These Earth Observation assets **provide a foundation upon which the UK could progress toward centralised discovery and access to a distributed geospatial marketplace**. The Satellite Applications Catapult is ideally placed to build on this for the benefit of the whole community and the current and future users.

The industry-led Industrial Strategy Challenge Fund (ISCF) 'Space Data Revolution' Challenge exemplifies the type of ambitious programme required to revolutionise the existing Earth Observation, and wider geospatial, marketplace in the UK.

All these initiatives, even as ambitious as the ISCF, must be supported by efforts to facilitate adoption of specific solutions to challenges in exploiting Earth Observation. This requires a coordinated approach to presenting options for UK government to invest in realising benefits from concepts such as Analysis Ready Data (ARD) and potential national Data and Information Access Services (DIAS). Satellite Applications Catapult should be a key stakeholder in undertaking such a coordinated approach.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Before the Commission considers any new technologies it's imperative that the systematic data access challenges across the public-sector are appropriately addressed. Unless geospatial datasets are readily accessible by end users and application developers it is not possible to realise the benefits of exploiting geospatial datasets using modern technologies.

Relevant technologies we anticipate impacting upon the geospatial sector over the next 0-5 years may be strategically broken into four categories: **user-led** data generation, information extraction, communication fabric and information dissemination.

Recognising the Commission is unable to remain at the forefront of developments across all the details of these, we raise four priority areas that should be championed:

- **Coordinating strategic Earth Observation concepts and initiatives** within the UK This is a recognised example where there is an urgent requirement for coordination across public and private sectors on strategic developments.
- **Demonstrating adoption of protocols and standards that enable distributed API access to geospatial datasets** across public and private sectors, is another objective the Commission is uniquely positioned to address through investment and policy intervention.
- **Advocating for geospatial within Artificial Intelligence-driven applications.** While significant topics such as ethical AI and explainable AI are being spearheaded into government by organisations such as the Alan Turing Institute and Government Office for AI. Championing, alongside organisations such as Satellite Applications Catapult, the importance of geospatial within these policy conversations is a role the Commission should fulfil.
- **Overcoming blockers to exploiting Artificial Intelligence within geospatial applications**. The Commission is well placed to champion into government existing and new efforts across the UK to overcome key blockers such as scarcity of labelled datasets and significant skills shortages. Example existing initiatives include AI4Space within Satellite Applications Catapult, Ordnance Survey's piloting of deep learning techniques for feature extraction, the Rural Payment Agency's exploration of machine learning for updating the land parcel information system (LPIS) and Office for National Statistics (ONS) Data Science Campus.

We envisage the Commission championing, but not being the lead protagonist in, these and other strategic initiatives that require significant coordination across the UK to deliver maximum social, environmental and economic impact.

The underlying technologies (some of which we identify below) are well considered across the Research Councils and Innovate UK, and organisations such as Satellite Applications Catapult are best placed to help UK capitalise for all future innovations and geospatial market demands.

User-led Data Generation

New datasets driving big data challenges (volume, velocity, value, variability, veracity, and verity of data) will drive new processing and exploitation opportunities.

- The proliferation of IoT devices
    - Energy harvesting low-power sensors (ultra-small and high performance), embedded sensor systems, meta-materials
- Space-based deployable structures
    - Greater technical specification (higher spatial and spectral resolution)
- Quantum Technologies

    - Atomic clocks for more accurate positioning
    - Sensing instruments, magnetometers and gravitometers for providing subtle changes
- New platforms and constellations (and **required policy changes**)
    - Video from space
    - Large satellite and unmanned aerial vehicles (UAVs) constellations providing near-real time (NRT) datasets
    - The emergence of high altitude pseudo-satellites (HAPs) (Zephyr etc.)

Information Extraction

The democratisation of analytics and the empowerment of a digitalised ecosystem. We are in a boom of analytical innovation, however in 10-20 years' time this will be a commoditisation that will imbedded into every device, car, robot, platform, data centre etc. Providing opportunities on these technologies on the coming years will be key to fuelling the geospatial industry.

New Processing Architectures

- Neuromorphic processing mimicking the function of the brain for real time patterns of life recognition
- Quantum computing providing a step change in multiple-iteration computing for generating new analytics models.
- Greater uptake and virtualisation of GPUs
- The intelligent use of CPUs, referal to only using CPUs for functions they excel at

Automation

- Automation has become mainstream, removing and empowering the human in the loop allowing 24hr supply chain changes and scaleable services through the automation of analytics (including, but not limited to, AI).
- Automated data ingestion, control data quality

Artificial Intelligence

- Deep learning neural nets (CNNS, RNNS, self-organising networks, GANs, unsupervised networks, etc.) leading to PaaS
- Semantics: search functionality, qualitative interpretation, data management
- AI algorithmic assurance monitoring, for trust in the models

Data Management

- Scaleable and adaptable infrastructures
- Lossless data compression
- Digital twins, will move from the individual assets to entire ecosystems, country wide digital twin systems.

Security fabrics

- Distributed ledger technology tracking metadata through a system (provenance of data)
- Higher levels of encryption (both on databases and small packets of data)
- Utilisation of quantum key distribution both in space and in terrestrial fibres (quantum entanglement and single photon sources)

Communication Fabrics

5G

- Ensuring the geospatial industry is prepared for next generation terrestrial networks providing greater levels of connectivity and security.
- Understanding the impact of high data volumes and lower latency of information exchange to the users

IoT Networks

- The maturation of IoT networks will provide a big steps forwards in NRT data collection, with networks like LoRawan, Zigbee, SIGFOX etc.

HTS and LEO Constellations

- High throughput satellites and low latency LEO comms satellites combined unrivalled geographical reach with “terrestrial-like” service quality

Information Dissemination

Web and Mobile Platforms

- The use of web and mobile platforms for the dissemination of geospatial services, products and data will continue to increase. It is likely that in the next 24months this will provide the largest exploitation route.
- Maturation of standards, licensing, access and update of open source software components
- Active user communities sharing innovation, accelerating the next evolution of technology

Augment and mix reality Visualisations

- As augment and mix reality visualisation hardware becomes more streamlined and less computer hardware intensive this technology will become more wide spread and a key method of data dissemination for in-field updates of geospatial data

Volumetric Displays

- Currently at a very early stage but has the promise to create a more social way of interacting with digital ecosystems.

Information as Information

- New visualisation technologies are great and have a place, but the geospatial industry will need to get better at just providing information in my circumstances, so integrating with additional client and customer information dissemination systems.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The Commission will provide a bridge into public-sector user requirements, creating demand and setting the foundations for adoption of future technologies.

The intrinsic relevance, ubiquity, volume and variety of geospatial datasets drives the accelerated roll-out of all future technologies.

This trend has already been observed in the AI and Cloud industries. With leading computer vision experts relishing the challenge of unstructured, multi-dimensional and temporal datasets to create more complex and deeper models, and single satellite archives reaching the multi-petabyte size further fuelling the cloud revolution.

UK’s leading position in geospatial should uniquely place government, industry and academia in further addressing important global challenges such as geo-diversity in the adoption of AI-driven applications.

It is now important to look to the future and understand which technologies the geospatial industry will be using in 5 years, to ensure necessary connections are made today to keep the UK at the forefront of the market. These will include:

- Data compression
- Wide area low bandwidth IoT networks
- Large data volume (large data volume, both as a single data point and as a collective dataset) for data provenance and tracking through the supply chain
- Driving AI assurance (tracking of morphing AI models and training dataset bias)

UK cannot realise benefits from geospatial data and applications underpinning the roll-out of future technologies if geospatial datasets are insufficiently accessible.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Whichever option the public-sector pursues for investing in its geospatial assets the Commission must ensure that investments are user-driven, evidence based and sufficiently long-term.

There are far too many options to discuss in any detail here so we have captured key considerations the Commission should make when deciding how best to coordinate future public-sector investments in geospatial data assets.

Continued investments via any option should:

- be **strategically** coordinated.
    - Investment cannot be ad-hoc and must be coordinated by a central body across the sector with a long-term outlook.
- allow a **devolved** approach to managing geospatial data assets.
    - Adoption of standards and best practise must be realistic and implementable with minimal overhead by relevant public-sector stakeholders.
    - De-centralised management of geospatial data and databases is essential, while enabling centralised API access.
- be **modular** and appropriately scoped.
    - Modularity provides opportunity for public-private sector partnerships and agile procurement.
    - Allows distributed, iterative development that can be scaled via Fast Followers across public and private sector.
    - De-risks investments.
    - Enables agile technology adoption.
- be **transparent** across both the public and private-sector.
    - Allows for targeting and cost-effective consulting of industry.
    - Effective propagation of lessons learnt.
    - Provides clarity over responsibilities for maintenance.
- be **evidence-based**.
    - Commission must invest in practically demonstrating the policies it wishes to intervene.
    - Evidence should be gathered within operational delivery environments, not isolated ad-hoc proof of concepts or generation of reports.

Commission-led investment should not be risk adverse. Investments led by the Commission should consciously explore opportunities considered too risky for individual public-sector stakeholders to undertake. Aligning these investments with those of public-private sector funding bodies mitigates risk absorbed by the Commission on behalf of the public sector.

Commitment of the Commission's own budget should strategically align with other funding mechanisms.

The Satellite Applications Catapult looks forward to continuing discussions with the Commission on details of the many options for public-sector investment into geospatial data assets**,** including other funding mechanisms with which it could coordinate.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Geospatial data alone does not have any requirements.

We expect the Commission to have a far more strategic focus than upon individual components of UK infrastructure. Nevertheless, we make some considerations of components we believe have strategic importance.

- **5G**: Ensuring the geospatial sector has in place the underlying infrastructure required for next generation terrestrial networks providing greater levels of connectivity and security.
- **Internet of Things (IoT)**: Ensuring data access protocols are suited for capitalising on the exploitation of near-real time data streams provided by ubiquitous sensing.
- **High throughput satellites (HTS) and low earth orbit (LEO) constellations**: these data sources combined with low latency LEO communications satellites shall provide unrivalled geographical reach with terrestrial-like service quality.
- **Analysis Ready Data (ARD)**: the unprecedented abundance of geospatial data raises significant questions such as whose infrastructure will be used to store and generate usable geospatial products that don't require an expert to integrate into value-add services.
- **GPS**: It goes without saying that UK must retain its expertise and leading position in the design, development and manufacture of this integral geospatial infrastructure. However, we believe the Commission should focus on downstream exploitation of this infrastructure as opposed to being distracted by the political battles currently afoot.

Both the public and private-sector should be more concerned about leading in delivering sustainable, user-driven value-added services from ANY source of location-based information.

Satellite Applications Catapult is a recognised protagonist across these areas and looks forward to engaging with the Commission as appropriate.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has and should continue to have a major role in the development and maintenance of the underpinning UK geospatial infrastructure.

Whilst there are specialist skills that are required to undertake this task when geospatial data is involved, the systems and software layers that are required are known to industry already, and in many cases are already deployed. They may not currently however be tailored to the public sector's specific needs or be scaled to the required size, so the recommended solution would be for the public sector to place service contract(s) to industry that clearly specify the service requirements and the conditions under which a service contract would be placed (e.g. ongoing performance requirements including penalties, access requirements, data sets, interface requirements, the need for flexibility for system evolution etc), and industry can respond accordingly with appropriate solutions.

The challenge to date has been the lack of coordination in bringing together the various public sector operational requirements to establish an overall procurement such as this. **The Geospatial Commission could be the ideal organisation to consolidate these user needs and to**

centralise service procurement. Special exemption to this approach might be required for users with national security requirements, however even those could potentially be met using industrial providers.

Issues such as vendor lock-in could be avoided via the specification of a modular system using open interfaces and this should form part of the service requirements.

The academic community is perhaps the exception to this, where service level requirements will be different, and IT researchers could support thematic based research users.

Enhancement of UK geospatial datasets is a more complex issue.

Well-established and routine data products could also be delivered by industry, however in many cases the use of geospatial data is highly bespoke and sometimes only needs to be created once to answer a specific question, and where the best knowledge of the problem is contained within the government department itself and not industry.

Outside of having appropriate access to geospatial datasets. It's important that the users (public sector, academics or industry) has access to simple and effective toolsets built on the underpinning infrastructure to allow the rapid fusion of fundamental datasets so that the users can create the outputs themselves. The definition of toolsets and the flexibility to include more in the future could be built into the service requirement for the underpinning infrastructure.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Significant public and private-sector value would be realised if geospatial data across the public-sector were made readily accessible. The Commission should coordinate a public-sector transition from being a reluctant customer within the UK geospatial sector to an active participant in the flourishing UK geospatial market.

Our response to Q4 clearly articulated the shared challenges to accessing public-sector datasets:

- Duplicative and disparate sources for individual datasets
- Lack of 'discoverability'
- Spatial and temporal inconsistencies
- Limited or entirely absent metadata
- Inefficient file formatting

We can reinforce our characterisation of the required solution from a user-perspective:

- Centralised Data Discovery
- Enhanced Search Capabilities
- Application Programming Interface (API) Access
- Real Time Updating and Live Streams
- Costing Models (i.e. Revenue Share, Pay-per-Use)
- Traceability and Provenance

As well as our breakdown of how value would be realised within the enabled distributed, agile, evolving marketplace, for example:

- **Reduced service development costs** (software engineering) associated with gaining data access from multiple access portals and API formats

- **Reduced maintenance costs** associated with hosting duplicative data access portal services
- **Reduced storage costs** associated with uncoordinated duplicative datasets
- **Improvement of existing value-added service**s (public and private sector)
- **Creation of novel value-added services** (public and private sector)

Previous attempts to address the underlying interoperability challenges have not been successful. These have encouraged adoption of strict INSPIRE and OGC standards. Investment in these initiatives has been uncoordinated and insufficient to ensure consistent implementation.

An opportunity exists for the Commission to coordinate investment that focuses on user-driven impact that can be evidenced through demonstrating the value of contemporary data access protocols.

If the value in adopting basic (and versatile) best practices is demonstrated with an operational service focus, then benefits can be conveyed in a much more evidence-driven manner across the public sector. Scaling adoption can then be via Fast Followers of the initial pilots.

Not realising this opportunity is a blocker to the UK (both public and private sector) unlocking the real potential value of its existing geospatial assets. It also prevents the UK benefiting from cost-saving and economic growth opportunities associated with agile adoption of the latest and emerging technologies.

Satellite Applications Catapult has a proven record in engaging with public and private-sector organisations with a focus on delivering sustained user and market-focussed impact. We look forward to discussing further ideas of where these opportunities lie with Commission.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission should be the leading protagonist in coordinating a public-sector transition from a reactive customer of geospatial data and services to assuming an integral and active role in shaping and benefiting from the rapidly growing user-centric UK geospatial market.

We evidence the case for the Commission coordinating such a transition in Q12.

Some important characteristics of the required public-sector investment are reinforced within Q9.

Similar considerations but specific to coordinating public-sector procurement of Earth Observation data and capabilities are detailed in Q6.

Key recommendations for coordination of public-sector procurement of geospatial data and services include:

- **Centralised procurement of geospatial data and services.**
    - Empowers government as a customer.
    - Prevents **duplicative purchase** of data and services.
    - **Significant discount** can be expected due to volume requirements.
    - Greater **competition** from data providers leading to lower costs.
- **Collation of requirements at Product-level, not Department-level**.
    - Allows all **application-specific dependencies** and considerations to be appropriately captured.
    - On a per-product procurement basis this allows Data or Service providers to be **more realistic** in their ability to meet requirements.
    - Undertaken at scale, enables the public sector to **optimise its strategy** to data and service procurement.

- Enables a **modular** and agile procurement approach.
- Focuses on **operational requirements** of public-sector not on ad-hoc project requirements

- **Re-evaluation of public-sector's role as a Customer of geospatial data and services.**
  - Public-sector geospatial datasets should be appropriately integrated into a public-private sector marketplace.
  - This allows local authorities (for example) to capitalise upon their existing and future geospatial assets.
  - It allows government to influence and benefit from the significant market growth being experienced by the geospatial sector.

The Commission should consult existing funding bodies and organisations with considerable experience bridging the gap between the public and private geospatial sectors. For example, leveraging existing networks of Innovate UK, Satellite Applications Catapult and Partner Organisations.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Commission should coordinate public-sector investment and initiatives that move toward single-point access for ALL public-sector geospatial datasets by ANY appropriate public-sector stakeholders.

It is unacceptable for geospatial datasets to not be readily accessible by all relevant stakeholders as and when required. The novel and valuable user cases that could be enabled by addressing this challenge too numerous to capture in our response, but we look forward to exploring these in future discussions with the Commission.

Public-sector commercial Earth Observation datasets represent a high-profile user case.

For example, Scaling Rural Payment Agency's Control with Remote Sensing (CwRS) through improved (fully discoverable) access to all public-sector aerial imagery and commercial satellite imagery alongside public sector mapping data which is often derived from the above.

Example geospatial datasets that would contribute substantial economic benefits through being opened to, at least, all relevant public-sector stakeholders include:

- Copernicus and Landsat Earth Observation Analysis Ready Data (ARD)
- Consolidated public-sector commercial satellite datasets
- Consolidated public-sector aerial imagery and LiDAR datasets
- Met Office climate records.
- BGS Geological Map products
- Rural Payment Agency (RPA)'s Land Parcel Information System (LPIS) dataset
- Broadband and comms service datasets
- Address Databases
- Local Authority-unique datasets
- Emergency services various datasets
- Highways England various datasets

As we have stated in other responses (Q4, Q12) this data access should have the following characteristics:

- Centralised Data Discovery
- Enhanced Search Capabilities

- Application Programming Interface (API) Access
- Real Time Updating and Live Streams
- Costing Models (i.e. Revenue Share, Pay-per-Use)
- Traceability and Provenance

An invaluable benefit in addressing this challenge is the ability for the public-sector to evidence and rapidly evaluate potential service improvements. Ready access to products and underlying datasets would enable cost-effective spin-up of sand pit environments within which to conduct collaborative public-private sector R&D.

Accelerating and getting these developments right is hugely pertinent as the public-sector moves toward responsibly realising the benefits from exploiting modern technologies such as Artificial Intelligence. It also allows the public sector to become an intrinsic contributor and benefactor to UK geospatial market growth.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Playing a coordinating role across the disparate UK geospatial strategies should be a priority for the Commission. The focus for this should be placed on providing top-down context across the various UK organisation strategies.

The Commission should work closely with UK organisations that are well placed across the public and private sector to robustly inform the Commission's own UK geospatial strategy.

This bottom-up approach is crucial to ensure that a UK geospatial strategy is sufficiently representative of all the leading work being undertaken in both public, academic and commercial domains.

Once the Commission has sufficient confidence in its own strategy we expect its Commissioners to play an active role in ensuring appropriate channels of communication exist to:

1. Maintain relevancy and representativeness of Commission's UK geospatial strategy
2. Contextualise regional or organisational strategy variations across the public and private-sector

The space sector is a recognised and leading example within government of effectively engaging across the entire UK landscape.

Satellite Applications Catapult's Regional Centres of Excellence underpin the ability for Innovate UK and Satellite Applications Catapult to recognise regional strengths and weaknesses and therefore drive opportunities for innovation and investment across the entire UK. Other organisations, such as the Knowledge Transfer Networks (KTNs) and the Geovation Hub, should also be relied upon to represent their own extensive networks.

Satellite Applications Catapult's approved 5-year business plan focusses heavily on realising the benefits of Satellite Applications within Geospatial Intelligence. There is clear opportunity to utilise the existing mandate of the Regional Centres of Excellence to support coordination of a UK Geospatial strategy.

Satellite Applications Catapult is ideally placed to support the Commission in developing its strategy. It is also already positioned as a neutral and trusted entity across the public and private-sector so could readily extend its mandate to helping the Commission act upon its strategy.

It is imperative that the Commission works with organisations at the intersection of the public-private sectors to appropriately tie the UK's strategy to **tangible components** that cut across the whole geospatial sector. This cannot be through opening individual datasets one by one or focussing on single organisations one at a time.

The practical components of a UK strategy are discussed at a high-level throughout our response

and should focus on overcoming the key blockers to public and private-sector growth.

Practical components of an overall UK strategy MUST be sufficiently funded with a long-term outlook.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The Commission should <u>invest</u> strategically to prove the value in adopting best practices across the entire public sector.

Local authorities face the greatest challenge to the consistent adoption of best practices in the public-sector. They also offer the greatest opportunity for realising the full value of public-sector geospatial datasets.

We recommend the Commission consider **two priorities** for addressing this challenge:

- Do not focus on sharing all best practise across all authorities. Focus efforts on one or two service-driven user cases that demonstrate value of contemporary data access protocols and rely upon Fast Followers (and below) to lead to the adoption of the underlying best practices. Adoption would therefore be evidence driven as opposed to policy driven.
- Use Commission funds to regularly convene and support local authority GIS teams and expand the Government Geography Profession to include local authority teams

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

We agree with applications included within the call for evidence and suggest the Commission properly engages key organisations sitting across the public and private sector to expand upon the identified priority areas.

We do, however, expect the Commission not to focus on individual markets or geospatial applications but on user-driven impact that can be evidenced through demonstrating the value of contemporary data access protocols.

As stated in Q4, the Commission can then address the much more pertinent question of which public-sector user-driven applications require **<u>minimal investment</u>** to evidence the necessary value to support policy intervention.

As a technology innovation company that is focussed on driving economic growth in the UK, Satellite Applications Catapult is actively collaborating with a wide range of UK and international stakeholders

across all of these markets and associated geospatial applications.

This uniquely places Satellite Applications Catapult to support the Commission in identifying these opportunities and we look forward to having an ongoing conversation around this topic.

Q18: Are there any other areas that we should look at as a priority?

We trust our response to Q17 sufficiently addresses this question.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

The most significant innovation across the public and private-sector would be creation of a dynamic and transparent user-focussed geospatial marketplace within the UK that bridged across the public and private sector domains.

We outline in Q9 the importance of geospatial in underpinning public and private sector adoption of future technology innovations.

We outline in Q12 the potential sector growth opportunities that could be realised through adoption of best practices across the public sector; these are key innovations!

Further policy intervention is required for the UK to fully capitalise on exploitation of unmanned aerial vehicles (UAV) platforms as sources of geospatial datasets. Associated regulatory discussions must only increase in prevalence as high-altitude pseudo satellites (HAPs) start to play a leading role in the next five years in sourcing geospatial intelligence.

Satellite Applications Catapult is well placed to contribute much greater detail to the insights and examples provided across our response.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We see significant opportunity in addressing the disparity between the presence that UK government expects to have on the international stage and the necessary investment to substantiate the necessary capability and experience behind that presence.

Three key areas should be considered for improving the UK's international presence in geospatial.

- **Sustained and amplified UK contribution to international committees, agencies and forums**
- **Proving <u>at home in the UK</u> the public-private sector business cases in operationalising geospatial capabilities**
- **A coordinated UK approach to addressing export opportunities**

While acknowledging UK has recognised world-leading expertise in certain areas of geospatial it is well recognised that organisations hosting specialised UK geospatial expertise are extremely poorly funded relative to their international counterparts. Funding for The UK Space Agency (UKSA) is a

good example, when considered against their French and German counterparts National Centre for Space Studies (CNES) and German Aerospace Centre (DLR), respectively.

If the UK expects to be taken seriously on the international stage investment must be considered with equal seriousness.

It is insufficient for individuals engaging on the international stage to expect to be taken seriously. Organisations they represent must be able to demonstrate their relevance within the contemporary international geospatial landscape.

This is challenging for any organisation with the current rate of technological change and the evolving importance of geospatial within this change. It is almost impossible for poorly funded public-sector organisations.

A clear opportunity for the UK lies in demonstrating the business cases in operationalising modern geospatial principles and capabilities. For example scaling Rural Payment Agency's Control with Remote Sensing (CwRS) through improved (fully discoverable) access to all public-sector aerial imagery and commercial satellite imagery.

Without operationalising geospatial capabilities, no public-sector savings are made and consequentially no evidenced story exists for the UK to present to the international community.

If the UK is not willing to invest in these opportunities at home how can it be taken seriously in exporting capabilities abroad?

Continued overseas investment via mechanisms such as the UKSA International Partnership Programme (IPP) is a highly effective means of increasing the UK's international presence. Increased coordination within the UK is required to fully capitalise on export opportunities represented by these international-facing programmes.

There is significant opportunity in using investment such as via UK Overseas Development Aid (ODA) alongside match funding from key international stakeholders such as Australia (i.e. Geoscience Australia, CSIRO) to achieve a common goal; for example tackling issues faced by Pacific Island nations.

Satellite Applications Catapult is uniquely positioned to play a role in the coordination of UK geospatial export. We have a recognised legacy in undertaking this role on behalf of and in collaboration with government and delivering on significant UK export opportunities through our market-facing Value Streams.

A strong differentiator of UK geospatial capability from other nations lies in not just having expertise in geospatial technologies but proven knowledge and understanding of what markets require as a user-driven solution.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Numerous examples exist overseas, many of which are noted in the Commissions call for evidence.

We suggest making a detailed case study of **Northern Ireland's LPS** as an immediate comparator and note the leading ambitions of the **Serbian RGA** and the work they are proposing under World Bank support. Centralised procurement in of the **New Zealand** public-sector is also particularly noteworthy, as is the unique balance between public and private sectors in the **Australian** geospatial landscape.

Satellite Applications Catapult has strong relationships with international organisations leading the way in exploiting geospatial datasets and looks forward to discussing our experiences with the Commission.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	SCISYS UK Ltd
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Overall we generally agree with the 4 geospatial data types: geospatial data, positional data, geospatial identifiers, geospatial services.

The following comments have however also been noted :

- Data descriptors and metadata to support interoperability are missing;
- We suggest OGC-compliant tools to help with cataloguing and data federation.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

SCISYS comes at the geospatial arena from the perspective as a software development house with a geospatial specialism. Therefore we encourage the commission to think about focussing on technologies that enhance the core geospatial toolkit thus widening its reach. These would include:

- Coding skills, particularly Python and JavaScript
- Database knowledge, including SQL and management scripting
- Experience with cloud infrastructure platforms for managing large datasets

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

For geospatial skills we find that software developers and Geographical Information Systems (GIS) users/experts are potentially easier to resource than those with experience in earth observation skills covering data processing/ management and analytics etc.

In addition, while there are many interested in the more recent technologies i.e. big data analytics, application of machine learning and artificial intelligence to geospatial data, it is more difficult to find a rounded person with complimentary skills to allow for management, project delivery etc. The market to secure these individuals is proving very competitive especially for those with an experience level between new graduates and senior/ very experienced.

Careers in the sector could be promoted through:

- Graduate fairs
- The STEM Ambassador Hubs (Hubs connect teachers, leaders of non-school groups, STEM Ambassadors and employers in order to build and inspire the next generation of STEM professionals).
- Social media
- Industry specific job boards
- Engaging with imagery and geospatial software suppliers to encourage more to host industry days, Special Interest Groups (SIGs), user groups etc.
- The MOD is also a source of users trained in a variety of geospatial skills. By connecting with these groups, their knowledge and expertise could be adopted into other public or private sectors.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

With regard to publicly held geospatial datasets it is clear that what is required is a wholescale revision of how this data is provided. At the moment there is massive variation in the quality, availability, physical format, cost and licence type in which public data can be consumed. Data.gov.uk is not really fit for purpose and the UK should follow international leaders in this area and set up a dedicated spatial data portal. This should include traditional geospatial data and earth observation data.

The commission should encourage all public data (that do not have a security implications) to be made freely available in OGC compliant formats. There is also a requirement to encourage the appropriate refresh of data especially for more dynamic datasets.

A good recent example of this is the confusing messages around the opening up of MasterMap. For many in industry this was a real opportunity to commit to open data agenda but what was announced was underwhelming and an opportunity missed.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

As above address data and standards should be fully open i.e. open data following open standards. Once this is resolved emerging technologies will then be able to innovate.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Currently in the UK there are initiatives/ programmes that have been set up for accessing various Earth Observation data sets however these are rather fragmented or organisations are carrying out similar work (i.e. for Copernicus data access, UKSA have invested access via the SEDAS hub while STFC have invested in the JASMIN facility).

Ideally there would be a joined up approach for access to geospatial and Earth Observation data in the UK. This would include considering the required storage and processing capacity, through to a delivery mechanism of analysis-ready data,

services etc to both government and commercial customers. The commission would be considered an appropriate body to coordinate the geospatial data requirements from UK government customers and also additional programmes including the UK Space Sector Deal, and the ISCF Wave 3 “Space Data Revolution” challenge proposal.

There is also the concern of the impact that Brexit will have on contracts with the EU Copernicus Programme for both current and future work to be undertaken as there is much opportunity here. In particular, there is the opportunity to input in the future direction of the programme which could benefit the UKs earth observation data requirements. Support from the commission to organisations such as the UKSA that are working on keeping the UK in such programmes post Brexit, would be encouraged.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are several technology areas which can be focused on to provide new opportunities

- Integration of new technologies. For example, artificial intelligence, machine learning, big data analytics etc which are already improving how geospatial data can be processed and analysed etc
- Delivery of services/ products. This is continually evolving with increasing advances and improvements in technology and so should reflected on how services/ products can be offered to consumers
- UK Technology Industry. UK industry and research is experienced in developing technologies such as smallsat constellations, satellite video constellations through to involvement in horizontal spaceport development across Britain. This is linked to creation of data and so investing in this area needs to continue.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

It seems slightly odd that the focus here is on the roll out of future technologies. Surely the focus should be on the roll out of future services that are delivered by future technologies and enabled by geospatial data and applications?

We would suggest by working in partnership public and private organisations will find appropriate scenarios where geospatial data and applications can support the rollout of future technology enabled services.

To support this we would echo earlier thoughts about the need for the public sector to truly open up data holdings to enable innovation.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Given current budget constraints and political focus it is evident that what is required is a sustainable approach for public sector organisations.

With this in mind we would suggest that organisations collect and maintain geospatial data that supports their core public purpose and their own operational requirements. As described above this data should then be made freely available using the OGL and OGC standards via a single UK geospatial data portal rather than the current plethora of portals.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Increasingly, end-users and developers of connected devices expect location-based services to be ubiquitous, but they are challenging to deliver in certain environments (such as deep underground or in areas where wireless transmissions are prohibited). Enhancing the capabilities of geo-positional handoff between traditional technologies such as GNSS and more niche approaches such as photogrammetric navigation-from video and inertial or barometric sensors will allow users to interact with digital content more seamlessly. Examples would be surveyors gaining an interactive understanding of underground utility networks using unmanned, location-aware robotics or users experiencing augmented reality (AR) guides to underground metro systems etc.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We would be in favour of the private sector supplying the development and maintenance of the underpinning infrastructure to the UK's geospatial data assets providing that it is made equally accessible to all UK stakeholders and that it was cost effective.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges include everything from the quality, availability, physical format, cost and licence type in which public data can be consumed.

Government should publish all data under the OGL and make it available using OGC compliant methods ideally via one UK spatial data portal.

Other than obvious budget issues the only barrier to this position would appear to be organisations own vested interests in the data and the confusing semi-commercial position that some public sector bodies have adopted which is often at odds with their public purpose.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

If this question means in terms of the public sector buying commercial data for the public sector as a whole then there are obvious economic benefits of doing this in bulk.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There are various data sets that would be useful if they could be accessed and exploited however it is often either commercially sensitive or privacy issues that complicate the matter. For example, traffic data feeds, crime statistics, social media, insurance claims etc. but also access to affordable high resolution, frequently updated satellite/ aerial imagery.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

It would seem that there are two main aspects for this

- You will need to square the circle of whether the approach is bottom up or top down. Given the move to regionalisation we would suggest that to get the buy-in from regions there needs to be a significant element of bottom up
- Basing the strategy on open standards will encourage interoperability between the regions

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Engagement and coordination with the Local Government Association (LGA) could provide most effective, see https://www.local.gov.uk/our-support/guidance-and-resources/data-and-transparency/geographic-information/geospatial

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

While the categories identified are rather broad in scope they are mostly well established in using geospatial data of one variety or another. Applications could be scaled up when combined with additional data sets or with new techniques such as machine learning or artificial intelligence. For example in the utilities sector, tunnels require regular inspections which are carried out by engineers and can be time consuming and pose significant risks. Robotic survey together with deep learning tools can now be used in tunnel inspection to automatically find, label and analyse features/defects in survey imagery. Combined with other geospatial data i.e. radar for subsidence detection, a greater picture can be provided regarding how the surrounding environment can affect tunnels.

Q18: Are there any other areas that we should look at as a priority?

With the continuing increase of earth observation data capture ie, drones, high altitude platforms, higher frequency satellite revisits and improving resolution, we would like the commission to encourage their development and uptake. Combined with additional geospatial data and processing or analytical technologies such as artificial intelligence and machine learning, there are continual applications and services being developed that can be utilised in the public and private sectors and potentially for export.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Services or products whose inputs/outputs include, or are derived from, location information would be seen as potential private and public sector innovations that rely on the use of geospatial data – example sectors could include smart cities, climate and energy, critical infrastructure monitoring, insurance, health etc.

Potential corresponding regulatory challenges could include :

- The General Data Protection Regulation (GDPR) regulation in EU law on data protection and privacy for all individuals, i.e. some attribute in geospatial data could hold personal data
- How geospatial data is collected from various sources i.e. drones, autonomous vehicles etc

Q20: How best can we make the UK's presence in the international geospatial world more visible?

In order to increase the UK's visibility in the international market, it needs to develop scalable ideas which include new technologies and data sources but also be a leader in open geospatial data to enable operating in the global geospatial community. The Department of International Trade (DIT) would also be a body to engage with to understand their guidance, export initiatives, experiences etc.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In Europe there are several Copernicus Data and Information Access Services (DIAS) which give unlimited, free and complete access to Copernicus data and information. A DIAS not only provides a cloud-based one-stop shop for all Copernicus satellite data and imagery as well as information from the six Copernicus services, but also gives access to sophisticated processing tools and resources.

In the US they have established a national geospatial "GeoPlatform" which is a platform that provides shared and trusted geospatial data, services, and applications for use by the public and by government agencies and partners. It is a shared infrastructure that can host a user's data and applications and can be seen as a focal point where governmental, academic, private, and public data can be visualised together to inform national and regional issues.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Scottish Environment Protection Agency (SEPA)
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There is a need for clear examples of each type to avoid assumptions, e.g.

1. Geospatial data: raster & vector
2. Positional data: address
3. Geospatial identifiers: TOID; UPRN
4. Geospatial services: Does this include WMS & WFS, or does it refer to applications such as Google Maps?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Spatial analysis skills as part of the school geography curriculum.

Support knowledge transfer fellowships between academia and public & private sector organisations, such as the NERC fellowships.

Establish fellowships specifically for Earth Observation data analysis.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a need for highly numerate individuals with good analytical skills and an eye for detail. Current gaps include machine learning and the application of artificial intelligence.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

A significant dataset that is currently difficult to access are the historic aerial photographs held by the National Collection of Aerial Photography (NCAP). The difficulty arises from the fact that in Scotland there are 1.3 million photographs catalogued of which 100,000 have been digitised. Having the rest of the images digitised would allow easier access to the archive which would benefit restoration projects on water courses and reservoirs. The photos allow the location of old river channels to be identified.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Release of UPRN is a good start.

Large number of buildings do not have a unique address when they are part of a large site (eg. hospitals, universities, industrial complexes) if this were carried out it would aid our ability to accurately assess regional flood risks.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Supporting the availability of analysis ready data for the UK public sector through the DEFRA / JNCC project. This will save organisations considerable amounts of processing time and enable greater use of the data to answer questions.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Cloud computing access for public sector bodies.
Maximising use of EO data through supporting provision of analysis ready data, e.g. via the DEFRA/JNCC platform.
Artificial intelligence and machine learning with EO data.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Vital for use with developing driverless vehicle technology.
Internet Of Things (IOT) sensors and monitoring

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Framework agreements such as the One Scotland Mapping Agreement have provided a method for Ordnance Survey to fund ongoing maintenance of detailed topographic data & a gradual improvement of 1:10,000 areas to 1:2,500.
Creation & maintenance of good quality metadata through the enforcement of existing standards.
The public sector generate a considerable amount of geospatial data – increasing its visibility and use will lead to quality improvements as issues are identified and then fixed.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Continue to support GPS base stations via OS Net.
Using data from monitoring sea level rise to see how this is going to impact the various Ordnance and UKHO datums.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Support the likes of NCAP (National Collection of Aerial Photography) in the digitisation of historic aerial photographs for the UK.

The private sector can often work faster and more flexibility and efficiently. In collaboration with the public sector this could potentially allow faster roll out of emerging technologies.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Access to local authority contaminated land assessment datasets is very difficult. Local Authorities are reluctant to share this information for fear of property blight. The creation of nationally consistent & open dataset could provide an incentive to cleanup contaminated areas.

In fulfilling our duties under the flood risk management act SEPA creates a large amount of spatial data with the aim of sharing this data with Responsible Authorities and national stakeholders and vice versa. Doing this in reality often takes time and resources and is constrained by the following:

- Licensing conditions
- Physical sharing of data i.e. which platforms to share it on (CD, hard drive, email etc)
- Lack of consistent software across all organisations to view and manipulate data
- Some organisations having a lack of technical staff skills to manipulate or simply view the data

Version control when new data is supplied to responsible authorities which supersedes previous versions

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The GC could act as central point of purchase and realise economies of scale when purchasing widely used datasets. The PSMA / OSMA has worked well and the same model has been extended to other suppliers e.g. BGS. The same model could be extended further e.g. CEH.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Centre for Ecology and Hydrology datasets such as Land Cover 2015.

Historic aerial imagery for the whole of the UK – from the National Collection of Aerial Photography. Uses for the data include the assessment of contaminated land, geomorphological investigations, historic river channel analysis.

Historic maps – support the National Library of Scotland in providing a WMS of all the OS paper map series.

LiDAR data – until the point of full national coverage, ensuring that as much of the data that has been flown is available as possible.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

It's important to reference the strategies developed by the devolved administrations.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Support initiatives such as the Scottish Government's Improvement Service Spatial Hub (http://www.spatialhub.scot/). The SpatialHub supports Local Authorities to provide spatial datasets which are collated into national datasets & made available as WMS / WFS to OSMA members. Having a single version of the truth at a national level is extremely useful.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

A fully populated national land register is a starting point.
An open agricultural fields dataset, e.g. derived from the SIACS (Scottish Integrated Administration and Control System) database.
E-planning – roll out an automated process to include the consultation process with statutory consultees.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Open access to SIACs data would enable an improvement in the modelling of water quality, which would help to identify those areas where mitigation actions will provide the most benefit in reducing agricultural pollution.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Carry on with implementation of INSPIRE.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The USA has a long history of open data which is used to support the wider economy.

Australia have launched a 'National Map': https://nationalmap.gov.au/about.html.

Estonia – use of blockchain in geospatial applications.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Scottish Government
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We understand the need to be clear on the terminology used in the development of a shared UK strategy and to help non-geospatial users understand the meaning behind these terms. However, as they stand they are ambiguous and much real data could be categorised under more than one data type – some real world examples would help to clear this ambiguity.

Also, positional data is not a commonly used term by geospatial professionals and perhaps thematic data or geographically referenced data would be a better fit.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Geospatial/GIS or geography skills can no longer be viewed as solely the ability to use a desktop GIS for analysis but much encompass a wide range of skills from cloud based analytics, programming, to geospatial data management. GIS professionals must also learn to working in multidisciplinary teams alongside other ICT professionals. This mirrors the digital fuelled evolution of the wider analytical and data science professions.

The Commission has already announced plans to make more core geospatial data open – Open MasterMap project. One of the main questions leading on from this announcement was how the Commission could support the market in making best use of this data - the availability of individuals with geospatial skills in the commercial world to be able to understand and make use of the data and the knowledge and awareness of business and policy leaders to allow them to identify the opportunities to exploit geospatial data and expertise.

We know that individuals with geospatial skills are increasingly hard to recruit in the public sector and this likely to be mirrored in the commercial world. Within the Scottish Government, we have had to accept that starting salaries mean we either appoint candidates who are underqualified in some areas (developing methodologies for data creation, understand geospatial standards, technically able to script in a range of programming language and geospatial database management and future needs of AI and Machine learning) or choosing to appoint candidates at a more junior level with the intention to develop them in the roles. It is clear that once they are trained up they have developed valuable skills and move on to post at a higher grade in SG or external companies(i.e. renewables companies). It is also important to note that these approaches have significant negative consequences: they reduce the productivity of teams who have to invest more time in developing and coaching staff and they increase pressure on a small cohort of specialists who retain the high order skills necessary to sustain business as usual.

To ensure they longer term capability, there are a few areas of focus:

A) To develop long term capability we need to start at schools – lack of awareness that geospatial is a career choice goes back to them. There are already a number of existing education outreach projects, some of these will have been touched on by other organisations responses but those we are aware of are :

- AGI Scotland - Geospatial Emerging Talent
- AGI - Early Careers Network
- ESRI - ArcGIS Online for Schools
- ESRI - GeoMentoring
- RGS - Ambassador Scheme promoting Geography/GI to schools

B) Within further education there are a number of areas that potentially train students in geospatial skills - MSc in GIS, Data Science, and ICT. Data science is a growing market and to meet this increasing demand a Scottish Government funded Innovation centre - DataLab runs a number of data science placements and secondments - https://www.thedatalab.com/what-we-do/skills-and-training. Whilst experience in Scottish Government has shown there is a still a lack of

geospatial training for data scientists this model developed by DataLab of summer placements/internships for data scientists working with private and public sector orgs is something we should learn from.

C) Improving the levels of geospatial awareness in business / decision makers. Many part of the public sector amass large amounts of geospatial data with little understanding of what to do with it, it sits underutilised and they don't value geospatial skills within their own organisation.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Much has been covered in Q2 but the main geospatial skills and gaps in Scottish Government are:

- ICT and business lack understanding of geospatial data
- Legal and Licensing – licensing geospatial data is complex and often a skill in itself
- Earth Observation and remote sensing skills – see response to Q6
- Experience of implementing accessibility standards, data schemas and publishing geospatial data – this includes data management and the creation of metadata.
- Future skills - cloud analytics and machine learning

The commission may have a role in mobilising organisations to address these issues at the organisational level, for example increasing the general understanding of geospatial across managers and ICT professionals but there are two professional development schemes that could be used to promote geospatial careers in the public sector:

- Government Science and Engineering (GSE) – Geography Profession
- Digital, data and technology (DDATS) profession - https://www.gov.uk/government/organisations/digital-data-and-technology-profession

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Addressing is the area in which there are the greatest number of reported issues and which is of the highest concern to users. Accurate addressing information, a single source of standardised addressing data, was a high priority for many parts of Scottish Government and needs to be resolved. Key areas mentioned: the Emergency Service Gazetteer; the 2021 Census; CHI – NHS health number; Persons at Risk register; Resilience planning; Superfast Broadband Reaching 100% Programme.

Other data with access, licensing or quality issues are:

- Marine (UKHO) data – complex licensing and derived data issues. The experience from Scottish Government is that chart data is available under commercial licence for non-navigational purposes, and only available in GIS ready format (raster/vector) from resellers such as OceanWise. Advice from UKHO IPR team is that derived material can only be used for internal purposes, and can't be released under OGL. For example - harbour limits dataset created by digitising descriptions and coordinates from legislation was provided to UKHO but the data supplied via OceanWise has not been updated. Where the legislation was unavailable for harbour limits, we used those depicted on the chart (as advised by harbour authorities). UKHO refused the request to share this data (for 5 ports) as derived data.
- Data from commercial infrastructure companies such as broadband network data for use in the Superfast Broadband Reaching 100% programme is often seen as commercially sensitive and very difficult to access.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes, Scotland (and the UK) does not currently have an addressing product containing all the addresses (or premises) in a simple, consistent and definitive manner. Existing addressing products are vast, complicated datasets which require significant skill to manage and interpret in order to extract relevant information, particularly in order to extract information on records referring to premises which may require delivery of a utility.

For example, in Scotland work undertaken by NRS to identify all relevant records required to conduct the 2021 statutory census is costly and time consuming. They are unable to guarantee the completeness and accuracy of the address register for census due to inconsistencies and flaws in the core data and its maintenance

regimes and the high number of records requiring manual assessment to classify record type.

There is also a lack of consistent advice on how to interpret existing products to identify premises leading individual broadband suppliers, market regulators and government to potentially take different approaches, in turn leading to variation in the model held by each body informing the extent of premises requiring a service.

Finally, the multiple ownership of the data and layering of intellectual property and licensing creates complexity and inhibits access to data. Royal Mail, Local Government (IS in Scotland and Geoplace in England and Wales) and OS and issues of complexities around who has rights to make changes and corrections as well as legacy inconsistency in the naming of addresses (i.e. tenements in Scotland) all need to be resolved.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

There are a wide range of potential EO applications in terrestrial and marine environments and Scotland has a strategic interest in making sure this potential is utilised. We want to ensure we are in a position to exploit the freely available outputs from the European Space Agency Earth Observation (EO) Programme (Copernicus), in particular Sentinel 1 (radar) and Sentinel 2 (imagery) satellites as well as other higher resolution satellite data. We have adopted a collaborative approach to EO; central to this is the Scottish Remote Sensing Working Group (RSWG), which includes members from a variety of agencies across the Scottish Public Sector. Members of the team also represent the interests of the RSWG at the wider-UK groups including the Defra Earth Observation Centre of Excellence (EO CoE). From both these groups the main areas of interest are:

A) Platform to allow public sector access to analysis ready data (ARD) and intermediate data (like water or vegetation indices) coming from EU Copernicus satellites and potentially other commercial high resolution satellite. Defra EO CoE has already delivered an Alpha prototype and is ready to go into Beta production phase. We would like to work with Defra, Welsh Government and Northern Ireland to ensure one point of access to all public sector in the UK. The platform should also provide the ability to carry out analysis /machine learning via tools in the cloud.

B) Continued access to Copernicus programme particularly the continued ability to use the Emergency Mapping service – this was recently activated by SNH to help understand and manage wildfires in Scotland.

C) An EO Skills framework is being developed by JNCC as part of the EO CoE and continued support for this work is essential

D) There are also a series of important cross-agency EO projects, with, for example DEFRA, SNH, SEPA and FCS, being coordinated by members of the

RSWG which demonstrate and promote the use of remote sensing data for a wide variety of applications. These include the study of diffuse pollution in Scotland's water environment, monitoring peatland condition, assessing wind damage in forests, mapping trees outside of Scottish woodlands, and creating a Scottish crop map. We would like to see this collaboration to continue but it will need additional resources.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

)ud infrastructure – Cloud platforms are fast becoming the vehicle for geospatial data storage, access and analytics, artificial intelligence, machine learning, predictive analytics, big data, and the Internet of Things. Cloud services can deliver agility, scalability, innovation, and potentially cost savings. However, this brings with it different cost models for cloud versus in-house infrastructure, trust/security issues, new skills and will challenge the traditional GIS desktop analytical methods and processes.

B) Machine learning – Increasingly used as part of EO projects such as crop mapping and assessment of catastrophic wind damage in forestry

C) Blockchain / Distributed Ledger – how we hold health data and how citizens engage with data

D) LiDAR and 3D technologies – Improved height data for modelling and forecasting by the public sector. This impacts commercial sectors e.g. planning / timber /insurance/ flooding

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Examples of technologies geospatial can support:

- Blockchain
- Micro satellites
- Integrating AI and automating mapping for on the fly imaging processing
- BIM
- 5G rollout

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

In Scotland the public sector uses and creates a large amount of geospatial data and it must ensure that it is well placed to maximise the value of that data. The effective maintenance of this data to ensure it is fully exploited, fosters innovation, delivers effective public services and promotes economic growth is an essential. Thoughts on where to invest:

A) Collaboration not duplication - Identify priority collaborative data procurements and data collection/maintenance projects through engagement with public sector organisations and data suppliers. Development of guidelines that help us to understand economic cases and issues like data sharing and archiving. Example projects would be Greenspace and Aerial Photography.

B) Investment in skills – discussed in Q3

C) Communicating the importance of GIS to managers/ decision makers - discussed in Q2

D) Implement and drive adoption of open data standards on interoperability and access – discussed in Q12

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

UK ground truthing product – Ground truth datasets exist across a number of public sector organisations, private sector data suppliers and research institutes. Could these be standardised and made accessible to create a UK wide product used to ground truth a range of remotely sensed data (ie Copernicus, LiDAR, aerial photography)?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

A) Innovation and collaboration – Scottish Governments CivTech programme has already demonstrated how it is possible to engage digital entrepreneurs and small businesses in developing solutions to sometimes intractable problems. Can this model be re-used with a focus on geospatial challenges? Examples of the projects can be found here - https://civtech.atlassian.net/wiki/spaces/CIV/pages/45847042/3.0+challenges

B) Implementation of standards - make their own data more discoverable and share (where commercial sensitivities allow) data – particularly infrastructure providers

C) Quality assurance role - 3rd party quality assurance on public sector data

D) Increase the wider adoption of the UK's geospatial assets – for example the development of Geovation Scotland hub and a tech accelerator / incubator programme or development of a geospatial cluster (through a network integrator) in Scotland drawing upon public and private sector expertise to build partnerships that can address the opportunities and challenges that access to good quality geospatial data enables.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

A) Discoverability of geospatial data -

- Scotland has its own geospatial discovery portal – www.spatialdata.gov.scot (based on GeoNetwork, also used by Environment Agency) which could potentially be rolled out for UK use. This is the single source of discovery geospatial metadata for the public sector, the site harvests metadata from other repositories and has an API to expose the metadata for use by others. This could mean, for example, organisation, could potentially remove the need to install, maintain and administer their own metadata stores (with guidance).

- Work with the Spatial Data on the Web group (a W3C group) monitor the work that will allow generic web search engines (google, bing etc) to view and discover information within CSW catalogues.

B) Improve the quality of geospatial data by setting out common standards, schema, metadata and identifiers

- Identify priority public sector datasets to address the issue of inconsistent use of standards, unique persistent identifiers, schemas and data lifecycles.

C) Encourage re-use of geospatial data in ways that minimise duplication of data

- APIs provide simplified access to data and offer an interface that exposes this data (and functionality) for the development of new applications, allowing the reuse of data and capabilities across a variety of services. They can be used as both a data delivery mechanism or a value-added service. Need to ensure technical standards are followed and end user support provided.

- Scottish Government already procures a data service wherein members of OSMA have access to data via a range of Web Services to give instant up to date access, reducing reliance on their own organisations IT infrastructure. Would like to see the range of data that is available by this route increase to include other data (eg. BGS data, UKHO, satellite and other EO (Q6))

- Many of the standards for geospatial are clearly defined in the EU INSPIRE Directive. The Directive requires member states to put in place mechanisms to make spatial data available to citizens and organisations. This means data must be published in a consistent format and web services created for accessing the spatial datasets. There is a need to up-skill the public sector on recording INSPIRE metadata, using the UK metadata standard Gemini (version 2.3 at present) which is machine readable and can be queried. Knowing what INSPIRE data and services are available and if relevant depends on the quality of metadata. It is also worth noting that the UK is a signatory to the United Nations Sustainable Development Goals (UNSDGs) which run to 2030 and have 169 targets, 78 of which have spatial data elements. UN Global Geographical Information Management (UNGGIM) is leading this work and will base its reporting mechanism for the spatial elements of the UNSDGs on the framework set out in the INSPIRE Directive.
- Multiple different licencing regimes making reuse complex. There are too many agreements and the interfaces between are often muddy.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

A) Encourage and support collaborations (be that data procurements or specific projects) within the public sector and help us understand how we can work more closely with private sector and academia. There are numerous government initiatives to do this but signposting these would be helpful (i.e. UK Innovate funding)

B) Point to relevant standards on accessibility, data and metadata as well as more general best practise for geospatial professionals

C) Engage with the professional schemes (GSE and DDATs) to develop basic skill set for geospatial professionals

D) Raise awareness of geospatial amongst public sector leaders

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Other geospatial datasets that we could derive significant benefit from are:

- National LiDAR coverage - There are several key advantages to the acquisition of a national LiDAR dataset to capture the nature of the physical landscape of Scotland both in terms of meeting statutory objectives and duties for a number of public sector organisations (SEPA, SNH, FC) but more widely in aiding informed decision making on the basis of common, up-to-date and accurate data being available. The main policy areas are those involved in critical national infrastructure management, flood risk management, the forest industry and environmental monitoring but could also be used for planning purposes.
- MET Office data – currently only accessible in obscure formats
- High resolution satellite data
- Access to commercial broadband network information – Superfast Broadband Reaching 100% programme

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Think of the strategy as a process of collaboration – define the process, understand the existing alignments (for example Inspire and EO), develop frameworks to work under were there may be variation in alignment for the individual strategies to fit under, set clear lines of communication and look at and learn from projects that have worked (for example Google project Aristotle and the Defra EO Centre of Excellence resourced by JNCC).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Scottish local government creates and maintains an extensive asset of geospatial information with significant value both within the public sector and to external organisations. However, the quality of individual datasets is inconsistent, reflecting historic priorities across councils and within different internal services, as well as the overall resources and capabilities available for ongoing maintenance.

The data asset is generally stored in departmental systems and silos and is largely inaccessible, under-used and consequently under-valued, therefore the resources available to maintain it have noticeably deteriorated in recent years.

Whist the data may continue to support the core functions for which it was created, there are significant barriers to unlocking the economic and public value. Market research suggests that opening access to the data could support at least £320M of economic activity at UK levels (based on a 5% share of the existing market) and support a wide range of commercial opportunities in land, property and planning, generating economic activity and supporting the local government tax base.

There is strong evidence of increasing demand for access to local authority spatial information with many organisations expressing frustration at the current time-consuming process involving contacting 32 different organisations, who may or may not provide access, and then discovering that the data doesn't meet the intended purpose. The Improvements Service SpatialHub has been gradually developed over the last three years and has well established business processes for the upload, quality assurance, collation and publishing of spatial datasets. The Spatial Hub provides access to quality assured local authority geospatial data through a single point through an (API). Future plans may involve:

- Benchmark for dataset quality - completeness and quality assurance.
- Review data standards, in terms of relevance and feasibility.
- Agree and implement data improvement programmes for datasets
- Harden and scale up infrastructure

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Dial before you dig – upscale this system used by Local Government to look at bin, gritting routes, meals on wheels.

Q18: Are there any other areas that we should look at as a priority?

Integration of geospatial data with business intelligence

Health and social care and the linking geospatial to health data

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

A) PARD (Persons at Risk Distribution) is a concept that has been pioneered by several local authority areas in Scotland and also in partnership with NHS Scotland along with emergency responders and other supporting organisations. The system is a means whereby a local authority can rapidly identifying a person or persons at increased risk during an emergency due to their proximity and vulnerability to a threat while prioritising support or evacuation to those persons if required.

The PARD system is compatible with any local authority social work data system and mapping system. The capital costs in building the system architecture within NHS NSS environment has already been met by the National Centre for Resilience (NCR) when they commissioned the implementation of the PARD system. The system will provide each local authority with the required data from health records to identify the vulnerable within that local authority area in the event of an emergency

As part of the process the NCR commissioned and funded the NHS NSS to geocode each individual health care record with a Unique Property Reference Number (UPRN's). These health care records would then be securely stored within folders, with each individual Local Authority only having access to their own health care data in the event of an emergency and subsequently deleted after the event. This process is essential to the success of PARD.

B) UAV's and regulation by CAA

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK needs to take a more active role in the international geospatial world (i.e. Inspire and EO conferences) and this active role should not just sit with Ordnance Survey or others in the 6 Partner Bodies (Geo6) who can afford the travel/ conference costs but, with the help of resources, should be opened up to a wider set of organisations.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- Smart cities – Singapore
- Centralised lists of accessibility and data standards and APIs - Netherlands

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

[Text Redacted]

Hello,

I know this is officially late, so my apologies for that. I just wanted to make you aware of Shared Assets' Land Explorer project.

We are a social enterprise think and do tank that supports people and organisations managing land for the common good. We support the development of new business and governance models and work to create the conditions in which common good land users can thrive. We support a range of common good land uses, from organic and community supported farming, to urban agriculture and community gardening, woodland-based social enterprise and community run public spaces.

A common barrier that many of the organisations we work with come up against is the lack of accessible and usable information on land. We carried out some research in 2016 that explored a number of these issues, and highlighted the potential for significant social and civic value to be created from government data on land.

We then sought some charitable funding to create a mapping platform, Land Explorer, which aims to bring useful data on land together with an easy to use mapping interface, with sharing and drawing tools. It's in its beta testing phase now and you can access it here: www.landexplorer.cc. We have been working closely with both Ordnance Survey, to integrate their base maps and deal with the associated licensing issues, and with Land Registry, to make some ownership data available to our users (this is still in development).

We believe that better access to public geospatial data could unleash a huge amount of civic creativity and enterprise that will have benefits for communities, the environment and the economy. We'd love to come and discuss this potential further with you and explain more about how we're creating Land Explorer, if that would be helpful.

all the best, and apologies again for the late response,

[Text Redacted]

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Sheffield Hallam University (The Centre for Regional Economic and Social Research, Department of the Natural and Built Environment, Department of Computing)
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Data type 4 "Higher-level insights and products" looks distinct. Data types 1 and 2 look as though they are not easily distinguished from one another and the distinction may be essentially subjective, depending on which agency is using the information. Moreover, all data has to be geo-tagged if it is to be represented on a map. For purposes of urban and regional policy and planning, the main field of application with which we are familiar, it would be better to distinguish between
- background spatial data (social patterns and physical topography);
- operational data (generated by operators such as water companies, bus companies, planning departments etc);
- data that shows the views and wishes of residents, citizens and consumers as for example revealed in the social media and local consultation exercises and finally
- data that maps activities, risks and flows of various types (traffic flows, energy use, flood risk, crime, pollution etc).

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The development of geospatial skills has to start at secondary school, including within the A level geography curriculum. A detailed examination needs to be made to determine whether the existing curriculum, as interpreted in schools and by examiners, develops an adequate awareness of geography as an exercise in spatial science. The main issues are the emphasis placed on quantitative data and on fieldwork. The current geography syllabus may be a little old-fashioned in assuming that researchers go out and collect new data, through fieldwork, rather than analyse existing data sets or use existing web-based material.
The issues with geography in schools have to be looked at in the context that by international standards, adult numeracy amongst is poor in England, according to an OECD report (2016) Building Skills for All: A Review of England. This being so, a wide ranging educational strategy will be necessary.
The creation of apprenticeship degrees is an established aspect of government policy for higher education and it is recognised in the Geospatial Commission Consultation. The potential of apprenticeship degrees deserves to be given prominence, both in terms of dedicated geospatial and geography degrees and in degrees in related fields, notably spatial planning.
There are specific skills, for example, in artificial intelligence, in network analysis and in raster analysis that may need more emphasis in the geography and GIS syllabus at undergraduate and postgraduate levels. The emphasis varies in different universities. The main need is for graduates who are generally skilled in digital and quantitative socio-spatial analysis and are adaptable for the future. The precise balance of skills is often difficult to predict and will in any case change over time. We would, nevertheless, suggest that the Geospatial Commission undertakes a scoping study to determine exactly what is taught in UK universities in existing GIS courses.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As is common in the field of computing and information technology, it is often not easy to find skilled staff for research or for teaching.
Sheffield Hallam University runs a full time, one year long MSc in Geographical Information Systems (https://www.shu.ac.uk/courses/geography-and-environment/msc-geographical-information-systems/full-time) whose graduates are very much in demand with a variety of employers. To counter shortages of skilled staff, the government could consider establishing a limited number of postgraduate bursaries. The availability of bursaries would help publicise the existence of current MSc courses and promote spatial science as a distinct career.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Much of the experience of staff at Sheffield Hallam University is in the field of applied knowledge, working with private businesses and the public sector and working in particular in the fields of urban and regional policy, urban development and urban planning. In that context, the main issues are less systemic data accuracy and more concerned with usability, access and interoperability.
Issues of access also arise for staff who work in the physical geosciences. A substantial element of this work relies on satellite imagery. Almost all currently collected publicly funded imagery from NASA and the ESA is freely available. However, some legacy data is difficult to obtain. Much data that is privately held (e.g. TerraSAR-X, Worldview, etc) is cost prohibitive for use in many academic projects, both for research or for teaching and skills development. Some new private companies are adopting policies of making their data (which is commercially very expensive) freely available for academic use. Planet.com is an example of this. Encouraging and promoting this kind of free sharing of commercial data for academic use should be part of the geospatial strategy.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The consultation document is correct to state that more needs to be done to ensure that geo-tagging and geo-addressing is undertaken on a more systematic and mutually recognising basis.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

See answer to Q4.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

In the applied policy field, artificial intelligence is the most promising, relatively new technology. Artificial intelligence is relevant to the making projections of the future, from all spatial levels from the street and neighbourhood to a city region and beyond. AI can also be used in risk analysis of various types and in product development (though this is not necessarily a geospatial issue). A national geospatial commission needs to encourage existing specialists in AI to take an interest in spatial issues and to work alongside those who already use geospatial data. To facilitate such an exchange of ideas, the Geospatial Commission needs to have strong representation from the universities within its membership as well as from the professions who use geospatial data. The professions include the Royal Institution of Chartered Surveyors and the Royal Town Planning Institute. A further priority, in which AI is probably also of relevance, is to link geospatial analysis to urban design and building information software, so creating visual, three dimensional scenarios of help to architects and developers.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

See the answer to Q4.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

See the answer to Q4.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The main priority is for the better use and integration of data and information already available rather than the acquisition of new data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector, often small companies, has been useful in generating small-scale applications. There are, however, limitations to the role of the private sector. First, government needs to be alive to situations in which a small number of consultancies have acquired data through their previous experience and are able to charge non-competitive fees for its release or for undertaking analytical work. Secondly, a reliance on the private sector tends to work against innovations that depend on common digital platforms linking data from a multiplicity of different agencies. Common digital frameworks require agreement and standards and more or less universal application if they are to work.
Thirdly, as has been documented elsewhere neither private nor public sector agencies have shown enthusiasm for innovations in the field of promoting or measuring environmental sustainability and liveability in towns and cities. See, for example the following report: the United Nations University Institute for the Advanced Study of Sustainability (2017) Policy Brief 12, Sustainable Smart Cities:Applying Complexity Science to Achieve Urban Sustainability, Policy Brief 12

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Researchers and staff at Sheffield Hallam University have used local public sector data. The main issue is that the data has been collected according to varying local practices over many years and also contains non-systematic inaccuracies and errors. There is, therefore, no simple technological device that might offer a solution to existing deficiencies. Data has to be checked manually. Once data is 'cleaned', there are established technologies, for example those concerned with semantic or ontological databases, that provide a flexible means of relating information from multiple sources. Evidence is available from the published academic literature.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

There are real issues of security, personal confidentiality and commercial confidentiality in the public release of data. In some cases, the confidentiality and security rules are themselves confidential and not reported with the result that the public and independent researchers do not know the range of data that might be released. A key role for the Geospatial Commission might be review the data release practices to determine whether security and confidentiality rules are justified. The Geospatial Commission would, therefore, most likely acquire a regulatory role in the release of data. The preparation of standards covering such issues as geolocation and spatial scalability would also be a useful role.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Local energy and heat use data could be greatly improved. Data exists in the records of electricity companies, gas supply companies and in some places district heating agencies. If these various sources could be aggregated and geo-coded according to a common framework, the results would be most beneficial in identifying priorities in energy savings and carbon reduction measures. Issues of privacy and confidentiality would have to be resolved- so this is a project that would be well suited to a Geospatial Commission.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The existing Ordnance Survey maps offer an excellent example of UK geospatial coverage. A common regulatory and funding framework could encompass all regions in England and Wales. A common framework does not prevent distinct applications in different regions. Property law and property institutions in Scotland are distinct, however, so suggesting some variations in approach. Scottish devolution laws might also require other variations.
Digital innovation in the UK is promoted centrally by the Research Councils, Innovate UK and the Digital Catapults. The regional distribution of funding from these agencies deserves very much more attention in case they exacerbate long standing trends towards public and private investment being concentrated in London and south east England. To promote balanced regional development, the Geospatial Commission should have its main office outside London and south east England.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Many local authorities lack the capacity, either in staff resources or expertise, to promote digital innovation and digital co-ordination in the delivery of public services. Local authorities face many other competing demands and have operated in a context of declining resources. Digital innovation offers a potential means whereby local authorities can improve the quality of their services, without additional major staffing implications. However, digital innovation has start-up costs and the uncertainty about the detailed application of various technologies also causes delays and further costs. Local authorities will require some form of direct financial assistance, for example a digital innovation grant and continued advice and support.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

There are multiple sources of data and information in the above categories, the relevance of many only become relevant in the context of specific tasks and research exercises. Identifying information requirements is likely to prove an on-going process.
In terms of immediate priorities, the following are suggested:
First, a cadastral map of England and Wales showing the totality of registered real rights in land and bringing together the information currently held by the Land Registry. The Scottish Government is already moving in this direction and private companies are collating data from a variety of sources. It would be of help if the preparation of a cadastral map were placed on a statutory basis.
Secondly, a parallel map of local planning decisions and policies. There are now examples of digital planning maps from London, Manchester and Sheffield and elsewhere. The details vary, however and the treatment of details, for example the boundaries of the sites of listed building or of scientific interest could be improved. The efforts of local authorities need to be undertaken to a common framework and standardised. The data and information sources used by local authorities also needs to be machine-readable, as is widely recognised and geo-tagged.
A combination of a detailed digital cadastral map, a detailed policy map and the existing Ordnance Survey topographical maps would greatly facilitate the identification of local development opportunities and local spatial planning. It should be noted, however, that development is also dependent on the location of infrastructure. Better and more comprehensive infrastructure mapping, including the underground infrastructure, this latter being recognised in the consultation document, is also required.

Q18: Are there any other areas that we should look at as a priority?

Health and liveability are an obvious omission from the list of high value information categories. Health and liveability go together (good quality housing, clean air, access to green spaces) and are central to public policy debates. Liveability is also central to the competitiveness of different towns and cities.

Satellite imagery is generally crucial to the health of the geospatial economy. The space sector has some of the highest levels of growth, GVA, and export share within the UK economy. Arrangements post-brexit must not be allowed to threaten this.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Social media can be used for sales and marketing and for mapping the location of a very wide range of commercial, cultural and recreational activities. The dominance of particular companies in the field of social media and the ownership of social media data are potentially serious issues.
Artificial intelligence, like the use of computerised models, requires ethical codes and codes of good conduct when applied either to the public sector and urban governance or to individuals. These codes would cover the reliability of the data, the transparency of their use and the avoidance of personal or community harm. The European Commission is currently preparing ethical guidelines (http://europa.eu/rapid/press-release_IP-18-3362_en.htm). These go beyond geospatial data, but it surely will be important that, after Brexit, the UK government develops parallel and probably similar guidelines.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK has a strong presence amongst international architectural, engineering and planning consultancies capable of advising governments on large-scale and long-term patterns of urban development, including sustainable development. Indeed there are only a few countries in the world with large consultancies active in this particular field. It might therefore be worthwhile for the UK government to work with and to promote relevant UK consultancies and UK universities active in this field.
Innovation and growth in all aspects of the geospatial sector is strongly linked to the work of universities, both through the provision of a highly skilled workforce, and through the conduct and communication of high impact research. These dependencies are particularly important for start ups and SMEs. As such, the lack of reference to universities and the links between universities and industry, in the consultation strategy is of concern.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

NASA and the ESA (European Space Agency) are exemplars of current best practice in terms of the open sourcing and online distribution of data collected using public funds. Otherwise, geospatial skills and analysis are so widely used that it is probably best to look at those countries, notably those in east and south east Asia, that already have good standards of technical education and high levels of numeracy. The future depends on the availability of a skilled workforce as is recognised in the first few questions in this questionnaire.

Thank you for your time in completing your response to our call for evidence.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Skanska UK
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Geospatial data: Information where ~~place~~ **location** is a key feature of its source and/or purpose for which it is used.

Positional data: Groups of individual datasets that usually have location as a secondary purpose, and which describes activity or physical assets grounded in a particular place.
We call this attribute data in the survey world.

Geospatial identifiers: Data that provides the means of anchoring positional data to core geospatial data. Is going to include date for currency knowledge?

Geospatial services: Higher-level insights and products, often involving layers of various types of spatial information. No comment

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

1. (Early years) From the unskilled infant to the highly skilled adult we all use of digital mapping and the things that change are the content and accuracy of the data. This can be taught to fun through sports linked to geospatial data. Geocaching, orienteering etc.
2. Business will find the best to use of data to drive efficiency, however common formats or national standards do not exist. I think the geospatial commission should be more parental and insist on a standards linked to naming and coding.
3. In the initial analysis document geospatial data linked to sales and marketing is mentioned, this same approach could be used for public notices and information. Also are advertising distractions linked to accident black spots?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

1. Teachers and careers advisors do not know that these opportunities exist. The website Geomatics.org was set up to help geo-careers be known to the teachers at an early age. A central careers hub is need in the right place on the web.
2. Clients do not know what data to collect and retain (we have gone from clip board to iPad in under 20 years), this means that UKPLC is working in different directions. Employer Information Requirements (EIR) should be part of project start up and include SPECFIC. Geospatial data capture requirements.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Land ownership and conveyancing is out of data always and the greatest purchase you make in your life is in the hands of people that do not understand geospatial data. Conveyance surveys that measure the geospatial location and the attribute data would be serve the housing market and the land registry. Lost land or unregistered would become a thing of the past if, surveyors had to measure the footprint of what was going too conveyed. This would assist planning authorise and the utility companies in their service proposals.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

1. Postal addressing in high raised apartment blocks is not linked to the actual height of a building and with the opportunity of drones delivering to the right address, the altitude in an address would enable the opportunity for safer delivery of parcels, or in the case of emergency drones a faster response. EG if Flat 6 on floor 3 was actually Flat 6 floor 18m you would have more data just be changing the addressing system.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK should invest in the state of the art imagery for the UK and its territories. The construction, surveying and planning could use this data to better evaluate concept design, survey, construction progress and the maintained asset.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The commission should focus applying what is good in one area and rolling it out nationally.
The use of "fix my street" or a consistent app that helps report issues and to local government. I find a good response time when using the app near my home. However other areas do not use it. This provides a real measure of what is reported, where, where and when it was resolved. This enables operational efficiency. An example of this would be that local authorises use roadworks.org and Highways England did not.(This may have changed)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

This subject is vast. We see this already in many apps already from warning in sat navs about speed cameras and speed limits linked to cameras on cars.
If the geospatial data of the infrastructure asset was mapped the orientation of vehicles travelling would have a more precise a location, due to software that will anticipate an obstacle. Autonomous vehicle assistance.

Accident blackspots would be recorded and assist the travelling public.
QR codes that displayed at the location of the advert or information poster will capture the best location to advertise.
Internal mapping of public buildings would ensure that people are able to find the location they require more easily.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

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Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

1. GPS (American satellites only) is not the term GNSS Global Navigation Satellite System (Russia/American/European/World).

2. The linear referencing system used along our infrastructure (marker posts) do not have a linear reference that could refer to all other assets along that route. Simple naming convention changes to use a linear reference system backed up with a geospatial position would help the building and maintenance of those infrastructure routes.
EG on the M1 motorway, the lampposts will be numbered 1/2/3/4 north or south bound. However the French toll road method would name them at linear distance along the route. 50/100/150/200. You can now see the lamppost is 50m apart and the distance along the route. If all street furniture was labelled in this manner it would aid the travelling public, the maintainer and the emergency services.

3.Lorawan The LoRaWAN™ specification is a Low Power Wide Area (LPWA) network protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The professional membership bodies and the private sector are writing client guides and standards while collecting data as per the client requirements. We are self-developing.

It is fundamental that the private sector innovate change, write standards and propose those standards, via professional routes. The Survey Liaison Group undertake this using members from ICES, RICS, and TSA.
https://www.cices.org/
https://www.rics.org/uk/
https://www.tsa-uk.org.uk/

The military have a large part to play in the capture and reuse of data and should be forgotten today's service man is tomorrows civilian and their mapping skills will be useful.

The clients see data capture this as a cost, a very short term view.
Legacy data capture is fundamental and should look past the current client.
Legacy data should be targeted at the main groups, beyond the current client Ordnance survey etc.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

1.Highways England use a mapping system that differs from Network Rail for engineering reasons(local grids).Those old mapping guidelines still apply, however how the population interacting with those maps has grown to a size that engineering reasons may be better solved locally, rather than over the project length. The majority of “mobile device” technologies do not unlock the potential due to local grids.

2. The compulsory adoption of best practice converted into client/commission requirements EG PAS 256 for utility location recording. The funding of BSI “geospatial “documentation should be funded by the government instead of private industry funding what is meant to be a national standard.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission (in line with their operating principle 2:2.1g) should fund a project to deliver a Topographic National Feature Code Library hosted by the Ordnance Survey using the relationship with partner body’s governance (5:5.8). The Survey instrument manufactures and software houses would adopt this National Standard. When Geospatial data is then collected via a survey device it would be in the right format from the first opportunity ensuring ease of interoperability.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Environmental incidents in a geospatial layer. The Environment Agency did have “what is in your backyard” service which was removed after 20 years. This has been replaced with a system that members of the public may struggle with.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

1. Ensure the local authority team is made up of specifically identified job roles linked to the geospatial data.
2, Telematics on local authority vehicles.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

1. Patient Health recovery times, did they recover at home, hospital or other.
2. Poor health attendance mapping, check-ups, appointments etc. This would then lead to a targeted education roll out.

Q18: Are there any other areas that we should look at as a priority?

Standards or standard gaps and where they align to the NGS.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

1. Emergency service response with future drone or autonomous fire engines. CAA rules and undefined flight corridors for service drones.

2.Autonomus deliveries and construction equipment

Mixed reality data awareness in construction and other industry would work better in this theatre. Adherence to PAS 256/128

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Be the first nation to have a national feature code library for surveying.
Support geomatics.org for careers advice
Use schools to host Geoinovation hubs
Remove VAT on GIS software for the next 10 years, to encourage adoption

Increase the Territorial army training in GIS.
Support Map Action, the charity, this could be linked to the armed forces.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Look at Australia and our old colonies for cadastral, Germany and their cadastral service.
Take to power of opinion from paper and solicitors and drive in the fact of digital geospatial data via appropriate accuracy.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Skyscan Aerial Photography
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X (niche business)**
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Include : making the substantial geospatial assets acquired by UKGov (presumably with tax payers' money) more widely available to the UK public and businesses.

This can be best achieved via specialist companies and partners, on a sensible commercial basis. This would benefit both parties; the UKGov receives a return on their investment in acquiring the geospatial resources and the UK private and corporate sectors would receive access to valuable geospatial information, much of which is currently locked away or generally unavailable.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

I am only qualified to speak on aerial photographic and related matters and in this sector I see barriers and lost opportunities.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Increased training in GIS programmes and methods will always be effective in increasing skill sets. There are specialist geospatial trainers.

The online data providers such as Google Earth and Bing Maps have massively increased awareness of mapping and aerial imagery over the last 20 years of the digital age. Nowadays consumers expect to find and utilise these products on the move. Promotion of careers in the geospatial sector can be linked to the use of these online web sites and products.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Yes.
Again speaking about aerial photography and related datasets only, there is a huge demand for these products but there are considerable challenges in accessing and using the data responsibly.
This is not helped by the mistakes displayed in some large and well known online geospatial datasets which are causing problems in the planning and legal sectors.
This is my area of expertise and the question about improvements is complicated and not for this questionnaire.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

I have no expert knowledge of this subject.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

I have little expert knowledge of high level Earth observation data, although I know of companies providing such imagery.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

I have no expert knowledge of this subject.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

A thought only. Thanks to Google Earth, Bing Maps and similar data providers, geospatial data is a way of life and must be factored into future technologies where it will become increasingly important.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

By making the data assets available to offset costs in acquiring.

As technologies improve, there will be a continual need to invest to keep up to date with new equipment and software. Therefore make the results of the acquisition available more widely to bring about a financial return.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

I have no expert knowledge of this subject.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

I suggest using joined up thinking.

In my specialist sector of aerial surveying, the capital costs and investment of resources to capture and maintain geospatial information is huge. The private and public sectors could work together to avoid duplication of effort and share both the costs and the rewards. This is beginning to happen but could be improved.

Q12. Do you face challenges when working with geospatial data from across the public sector?If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes, our company faces challenges, particularly with Ordnance Survey (England).

There are suggested remedies but I prefer to discuss them in person with OS to see how the value could be better released.

Ordnance Survey (Northern Ireland) have been the opposite and their helpful attitude is commendable.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

I can only offer suggestions for aerial photography and related imagery.

We often act on behalf of the public sector and I would welcome the Geospatial Commission opening the way for better access to geospatial data held by UKGov. There may be possibilities but there is no quick answer for this questionnaire.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

I can offer suggestions only for aerial photography and related imagery.

Yes, I am sure there are partner bodies who hold such datasets. Without knowing details of the partner arrangements it is difficult to offer suggestions and there are no quick answers for this questionnaire.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

I have no expert knowledge of this subject.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The majority of our clients are concerned with property and land, for planning, construction and legal issues.

There are great possibilities for developing these markets but this is the core of our business and it is not appropriate to give details here.

What would help this development is an unlocking of geospatial data held within UKGov.

Q17: Are there any other areas that we should look at as a priority?

I have no expert knowledge to offer.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

I have no expert knowledge to offer.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

I have no expert knowledge to offer.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

I have no expert knowledge to offer.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Socitm www.socitm.net
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Other - please state	**Professional association**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Please note that we have chosen to respond to those questions selected by us as most relevant to the local government sector.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Availability and sharing of relevant staff skills and knowledge is a significant factor in maximising the benefits of geospatial data for local authorities and their partners. Technical skills in specialist applications can be expensive to acquire through formal training.

Firstly, more emphasis could be given to informal sharing of knowledge and best practice though online user communities such as exist in the public service Knowledge Hub. Targeted demonstrations and case studies relevant to specific business areas can increase awareness and encourage authorities to improve skills, leading to better utilisation of data through existing or new solutions.

Secondly, development of regional/sub-regional shared centres of excellence (e.g. the Scottish Spatial Hub) offers a way to attract and maintain skills, alongside improved partnership working arrangements with universities, the private sector and others.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The quality of spatial data captured and maintained by local authorities depends on the availability of high quality and up-to-date topographic mapping as supplied by the Ordnance Survey MasterMap products. In the case of Scotland, for example, the cost to local authorities of accessing and using such data, through membership of the One Scotland Mapping Agreement (OSMA) can be in excess of £100k per annum for each council. This annual cost is becoming an increasing financial burden that can be difficult to justify in an era of freely available online maps. MasterMap data is becoming freely available to certain groups and would therefore expect a reduction in the level of charge to the public sector customers.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Data standardisation and sharing within and between organisations can often depend on the technical architecture and capabilities of business-specific IT solutions, and therefore the providers of such systems should be required to fully support open standards for both data and interoperability.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Wider acceptance and use of location-based identifiers such as Unique Property Reference Numbers (UPRNs) and Unique Street Reference Numbers (USRNs) within non-spatial applications would enable data held in such applications to be "spatially enabled" and thereby opened up to new ways of analysis and presentation.

Tighter procurement regulations and greater vendor engagement at national level could help improve the technology used by authorities. Increased availability of standardised, open geospatial data can also help drive innovative uses of such data, for example in the availability of mobile apps.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Socitm feels that the question is phrased too narrowly. The opportunity is not just coordination and sharing of best practice in harnessing location data between local authorities, but also doing so across a wider landscape of places by involving the many different organisations that contribute to achieving better outcomes for residents, communities, employees and businesses in those places, while protecting and enhancing their environments.

Further, the use of geospatial data across these groups extends to spatial analysis, exposing patterns that cannot be identified unless this extra dimension is available.

There are many opportunities within the sector that should be addressed, and that Socitm would be keen to work with the Geospatial Commission to develop. Key amongst these are:

Promote open data (including further opening up OS mapping and address data as a public good) and open standards for data acquisition, publication and sharing.

Support and facilitate wider acceptance and use of location-based identifiers such as Unique Property Reference Numbers (UPRNs) and Unique Street Reference Numbers (USRNs) within non-spatial applications. This particularly problematic in respect to sharing data across social care, emergency and health services as certain organisations incorrectly regard street and property data as personal information.

Sponsor preparation of specific high value propositions for geospatial-centric applications, supported by template business cases. Currently, the opportunity is being missed to increase the pace of adoption and realise the benefits this would unlock. We list below seven key use cases that closely align with Government policy:

1. Understanding patterns of democratic engagement/disengagement - most local authorities hold very detailed demographic data but it is rarely combined with spatial data which could reveal the detail of such patterns.

2. Regeneration of economically disadvantaged areas - spatially enabling inward investment marketing materials and use of 3D models to allow initial evaluation of candidate sites from the developer's desktop.

3. Uncovering poor housing conditions and illegal multiple occupation - highlighting existing best practice using thermal imagery and the role that high resolution 3D city models can play.

4. Building social cohesion and overcoming loneliness - using disaggregated social care data to identify deprived communities at a much more granular level than is possible with census data.

5. Environmental management - clearly articulating how Geospatial supports more effective disaster risk management, air and noise pollution monitoring and climate change mitigation.

6. Supporting development of micro energy generation/grids to identify the best opportunities to increase local adoption of generation from renewable energy sources.

7. Distribute access to technology (e.g. high speed broadband) and its benefits. One strong use case is increasing the use of public street light networks to provide wider low cost access to optical fibre based networks and increased availability of public wifi in city centres.

Build capacity, capability and skills - data aggregation, standardisation, handling and sharing, data science, analytics, consumption - harnessing established centres of expertise e.g. Data Mill North, Worcester Office of Data Analytics, etc.

Invest in existing knowledge sharing networks and platforms - Socitm with its established regional groups, other professional bodies (Solace, CIPFA, RTPI, etc.), Local Government Association, Welsh Local Government Association, Scottish Local Government Improvement Service (Spatial Hub), Scottish Local Government Digital Office, GeoPlace, Knowledge Hub.

Provide hypothecated investment funding, stimulating and building the engagement to enable adoption and adaptation of best practices at the local level. (There have been some successful examples e.g. The Connect Digitally programme – online school admissions and online free school meals that invested in a team of professionals to work with those responsible across England to embed the process and associated technology in their local authorities.)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Use Socitm's international network – LOLA (the Linked Organisation of Local Authorities), comprising professional associations for the IT, digital and data communities in Australia, Belgium, Canada, Netherlands, New Zealand, Sweden and USA. Further details: http://www.lola-ict.org

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Numerous examples of local authorities leading the way exist in parts of Australia, New Zealand and Canada, with applications including forest fire prevention and response, and flood mapping and prevention. Some examples, focusing on the application of drone technology, can be found here: http://www.lgam.info/drone.

Perhaps the most comprehensive example is the work of the Tasmanian Spatial Information Council, whose primary purpose is to "facilitate full access to, and application of, spatial information to underpin Tasmania's economic, environmental and social prosperity".

In terms of promoting data standardisation and sharing, a working example of best practice is the Scottish Local Government Improvement Service's Spatial Hub web portal for the upload, download and consumption of Scottish geospatial data. Individual councils and national park authorities upload various spatial datasets to the Spatial Hub, which are then standardised, merged together and published to create national datasets. This can save local authorities a great deal of time, money and effort in developing their own portals to publish data for their EU INSPIRE directive obligations. Additionally, it provides full and up-to-date national datasets for various public bodies in Scotland, as well as potentially diverting FOI requests away from local authorities.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Space Syntax
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**x**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Open access to the OS AddressBase products would be extremely valuable to Space Syntax, along with many other SME's. The fees currently associated with accessing the products, which start from £130k per annum, are prohibitively expensive for small businesses and are a barrier to growth.

Specifically, the release of the data would enable Space Syntax to create a high value add to our existing consultancy and data services. This is for two reasons; firstly, because it would enable us to structure our data in a highly accessible format, allowing it to be incorporated into BIM Level 3. This would bring an urban context to BIM Level 3, by enabling us to collaborate more effectively and efficiently with a much broader stakeholder base, in the fields of architecture, design and property.

The second is that it enables us to undertake advanced analytics and create integrated models of the urban environment. These models can be use by non-

specialist users and the outputs have been found to correlate with long-term social, economic and environmental outcomes, as well as health and wellbeing outcomes. This therefore extends our client base, as we can sell our products beyond a small field of specialists in planning, as well as potentially provides positive societal benefits.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

To have an urban focus, as well as a rural/agricultural focus. As urban focus will benefit multiple professions and support critical social, economic and health outcomes for citizens. It will also help address the need to manage urban expansion and the risks of ecological and environmental damage.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

A key challenge that Space Syntax faces when working with geospatial data from across the public sector is related to interoperability. A specific example of this would be the difference between OS (British Coordinate System) coordinates and Google (WGS84) coordinates, which means that combining datasets is problematic, leading to inaccuracies and concerns about the robustness of the datasets. This situation limits our efficiency, addressable markets and scalability, as we have to develop tools for the UK market and tools for the rest of the world.

We would recommend two approaches to help to address this;

Firstly, we would recommend going beyond standards and developing a process of validation prior to the data being released – this could be led by OS. Secondly, we would recommend supporting a range of initiatives such as the current ODI 'Local Government Open Geospatial Data Stimulus Fund' which is designed to grow the public sector's understanding of how to collect, publish and use open geospatial data, with a specific focus on collaborative approaches.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

There are many excellent geospatial applications across various technology readiness levels (TRLs) which have the potential to capture economic value. However, the first three high-value categories identified are highly contentious, often politically driven, areas of public policy in particular. Therefore, while it is important to consider specific applications which can support decision-making in these areas, it is equally important to understand and analyse the eco-system in which they would operate.

We would recommend that the Geospatial Commission reviews the insights and analysis gained from the Tombolo project, which was conducted using SBRI grant funding over three years and undertaken jointly by Space Syntax and the Future Cities Catapult. http://www.tombolo.org.uk/what-is-tombolo/

This project helped city authorities understand the value of their data and developed a range of products and services in order to support them in this aim, including a *Digital Connector* - an open source piece of software, which allows data specialists to efficiently connect data sets into a common format.

The project gathered a range of insights from city authorities who operated as project partners, into the ways in which different officials and professionals across cities collect, interact with and utilise, data to undertake their roles and deliver services for citizens.

These insights informed the development of the Tombolo products and services, but would provide valuable evidence for the Geospatial Commission in their consideration of initiatives across the high value categories they have identified.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	STFC Hartree Centre
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	**Publicly funded research organisation (in collaboration with IBM Research UK)**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The high-level view is accurate as the definition says that geospatial data is any data that is associated with some spatial information. Some points that could be included to clarify the definition:

- Is indoor data such as building layouts also considered—e.g., airport layouts to better assist travelers OR proximity markers or relevancy measures w.r.t. social data to cluster individuals.
- Geospatial data also requires time identifiers – e.g. single date/time, average over a period, multiple times for the same place.

The definition could be extended to include:

- any data that is in principle attached to a location but is not referenced as such - with some intelligence we might able to understand where a place is.

We note that the definition could be considered overly complex. In the consultation document, the use of "place", "location" and "geospatial data" almost interchangeably is confusing. Examples of each data type would help to clarify the differences.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The paper looks at geospatial skills very much from a "geography" perspective, but it is also important to consider how to approach this from the data science/computing science direction, perhaps providing short professional courses to add geospatial skills to those areas. Probably an online course about "What is geospatial data" could be a good starting point, and some good quality training videos and demos on government infrastructure.

Providing incentives for SMEs and/or larger organisations to upskill their employees on the subject area—be it training their staff (especially low skilled) on professional courses or helping the educational institutes to run specific courses/degrees on the subject area. Though there have been such efforts, sustained funding for such activities has not necessarily continued.

Non-technical users will have different requirements in terms of skills than technical users – e.g. training in using GIS software packages to query existing data versus training in how to integrate live geospatial data into web apps, or more complex 'data wrangling'. Training also needs to be continuous as technology evolves rapidly. For example, one area not well covered is tracking and deriving information from moving objects (e.g. cars, people).

The key is to end fragmentation and setting up standards between organisations and companies, so that everyone is taught similar tools and software so if people switch companies, their skills are transferable.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Using vs understanding geospatial data are two different things. Developers of technology which exploits geospatial data will need an in-depth understanding in order to develop novel techniques to efficiently and effectively extract value. For example, given the increasing resolution in geospatial data and real-time decision-making requirements, developers will have to consider different approaches and be able to say that the approach provides some % speedup in the analysis and decision-making process. On top of upskilling staff, the commission could consider running multi-year challenge-driven research programs with clear deliverables of impact in the public or private sector.

Geospatial data skills should not be treated differently to other analysis skills, since people who work with Big Data, do machine learning etc, can easily expand into the geospatial area. At the moment it is restricted as a skill to degrees such

as geoscience, environmental studies, meteorology etc. However with mobile phones and the internet, almost everything these days can have a geotag, so all the Big Data degrees could have a geospatial component integrated so everyone taking these courses have the opportunity to gain the relevant skills.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

One good way to make access easier would be a national data discovery register. This would make meta data about any data source discoverable so that requirements of people, organisations, and projects could be mapped to the relevant data sets. Some data is always going to be proprietary, but having a mechanism to discover such data through their meta data may enable parties to request access to them for specific purposes. Such a registry would need to be distributed and be based on a platform such as blockchain for transactional guarantees and transparency.

Data access needs to be improved. Different industries will always have different needs, but if data were easily available through a single platform, then access would be straightforward. For example, The Opengov website has a lot of data but all is fragmented and offers links to other websites which contain files, and the licences are not clear. If the Opengov website had just a single access point with clearly defined licences and an easy search tool, all data could be made available i.e. through something like IBM PAIRS (https://www.ibm.com/uk-en/marketplace/geospatial-big-data-analytics) where it's all in one place and also cross data-set queries are allowed.

Licensing existing data under OGL or equivalent open licence is fundamental - we often find potentially useful datasets e.g. from local authorities which would be of great value to commercial customers, but cannot be used for that purpose.

As a specific example, more local authority data (and more consistent data), in the areas of planning and local plans, would be hugely valuable for the construction industry. We are currently working with brownfield registers from local authorities across the country, and although they are supposedly all to the same template, they quality of data is vastly different, and not all are released under the OGL (or it is unclear).

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Amore precise method of addressing than postcodes, especially in rural areas, will enable new applications. Postcodes are already inadequate for sat-navs to find properties in rural areas. Something like https://what3words.com/ could work for any non-address location.

Given the uptake in mobile communication protocols (such as 5G) new encoding paradigms may need to be considered as data storage requirements will increase. Given the potential density of a 5G network, one may also consider means to provide inferred geo addresses to data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Having looked at the potential for using EO data for a project, there still remains a huge challenge in providing "analysis ready" data without losing fidelity e.g. georeferencing images.

Investing in analytics platforms (especially distributed analytics platforms) and supporting projects in this space is needed as the resolution keeps increasing for fine-grained analysis. Also, with the uptake in hyperspectral imagery to better understand environment, this data size will continue to grow. Distributed analytics platforms will be key as transferring data from disparate and distributed data sources for central analysis may not always be possible.

For a platform to be usable, it needs to be scalable and hold (or provide access to) all the data but also offer the capability to analyse the data in-situ and create new datasets. For example, you can use multiple satellite images to get rid of cloud cover but if you want to do that for the whole world, you need large-scale analytics.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Distributed data discovery platforms and analytics platforms to better exploit data. Such platform should also provide model sharing and value-added data products for cross industry consumption. These should be supported by large compute clusters and include tools like IBM PAIRS which aligns data and makes it easily accessible / queryable.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

A pioneering dev-ops platform could be created where the government provides a space for new technologies to be developed (like a startup garage) and then allows exploitation through that platform; it's all about sharing today, no single company, government or system can solve the world's problems, that's why open source is now so popular but large organisations and governments need to provide the platform and space to host this. Some example applications include:

- A single geo-enabled catalogue to easily browse available data. See e.g. https://catalogue.ceh.ac.uk/eidc/documents
- Tools to access multiple pre-processed datasets in a common format while maintaining high spatial and temporal resolution.
- Tools to extract user-relevant data (time and place) from large geospatial datasets
- Real-time data access to constantly updated data sets.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Mainly by adhering to an open standard for data publication and expanding on programs such as open data initiative to expose all geospatial data. Additionally, the transformation of data needs to be transparent and provenance (and associated matrices) of data and processes need to be published.

Having effective business models to incentive organisations to share data is key:

One way to encourage organizations to share data would be a data market place/open innovation platform, where people can share their data for free but have in turn access to other datasets they would usually pay for.

Also service providers could share a small percentage of their profit with the open sector organisation if they use their data to provide services, i.e. per API call or data set access.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Indoor position systems are key for future business propositions—be it retail (grocery) or people navigation. The current techniques to indoor localization are poor, thus investment in this area has potential high impact.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector has a key role to pay not only in development and maintenance of the infrastructure but also on the fundamental research on developing the next generation infrastructure supporting geospatial data. This is mainly because value proposition for a such an infrastructure predominantly lie with existing and emerging private sector organisations—be it logistics or emerging businesses on Internet of Things and Connected and Autonomous Vehicles.

Private companies host the skills and hardware to run these platforms, large tech companies need to be involved as no government or public sector organisation alone will have the skills and expertise to maintain and set up this infrastructure.

Setting up and maintaining an infrastructure is huge challenge and therefore needs to be approached as a large scale IT project - geospatial data is true big data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

One challenge with working with data across the public sector is inconsistency in the geospatial identifiers used e.g. for local authority boundaries. In a recent exercise to bring together datasets, some used Ordnance Survey "boundaries_GB" shapefiles, and others used "census" shapefiles, both with different identifiers for the authorities. This increases the amount of manual work, and potentially leads to inconsistencies and errors. A standard approach would be extremely beneficial.

The Opengov website is a good start, but difficult to use in practice - data is available butt very hard to find, the search option is terrible and not clear which datasets are available under which licence, whether there is actually data, what the resolution is and then it is just in single files and not easily downloadable. It could be organised a lot better.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By creating a single portal from which to access all open data for the public sector, this way it can be monitored and the geospatial commission track which organisations do geospatial data well and have a high buy in and which need to do better.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Access to British Geological Survey data would allow for interesting research with soil and rock types as an input. Availability of up to date observed weather data (e.g. Met Office UKCP09 project http://catalogue.ceda.ac.uk/uuid/87f43af9d02e42f483351d79b3d6162a, available to 2016) would also allow interesting research, such as some work we did last year looking at driver behaviour.

Open Street Map (https://wiki.openstreetmap.org/wiki/Main_Page)

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

More work is needed to roll out consistent templates for data, meta-data and storage to local authorities, and to provide training and/or technological solutions to ensure these are completed consistently (e.g. no text in numeric fields). A suitable forum for sharing best practice across local authorities would also aid consistency.

It is impossible to introduce standards from top down. An alternative bottom up approach is a traffic light system which indicates data quality, i.e. if organisations want to share their data and add to a given platform, then they have to get a "green" first.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Some examples based on our experience interacting with businesses at STFC Hartree Centre:

- Property/Land: i.e. Hartree use case for archeology
- Also feeds into construction
- Mobility: IBM/Hartree train delays, smarter traffic management,
- Sales/Marketing: Large supply chain analysis, Food sector
- Natural resources: This must be a key area because of energy and also continuous catastrophic weather events happening more frequently, i.e. name Hartree project for flooding and emergency responses, there is a lot that can be done here,

Q17: Are there any other areas that we should look at as a priority?

To face the current shortage of resources and high demand of services due to an ageing population, healthcare must be a key priority. The use of geolocation (both indoor and outdoor) data provides unprecedented opportunities to monitor patients daily activities remotely, allowing to shift the care paradigm from a reactive to a preventive healthcare system, optimise the use of limited healthcare resources, and understand the risks. This is particularly relevant to aging and mental health, where changes of behaviours are key factors indicating disease worsening/onset.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Key innovations and applications will come through mobile apps and all the services related to this, e.g. Uber

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Provide a high quality data catalogue/repository - the UK could be the first government in the world who provide all their data through a single portal and provide an open innovation platform, that would be a first and world leading.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Response from the Surrey Geospatial and Space Leaders Group –

23 organisations operating in the Space and Geospatial Sector in Surrey

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It is important to come to a shared understanding on this point. Geospatial data types 1 to 3 are reasonable in our view (note: #1 is recursively defined), although it can be hard to differentiate between type 1 (geospatial data) and type 2 (positional data). The type is sometimes determined by use cases, rather than anything intrinsic to the data. Type 4, Geospatial Services is somewhat ambiguous. Services are usually defined as a method of delivering geospatial data, but the definition seems to imply value-added/derived data. i.e. data that is moved up the value chain towards "geospatial intelligence". Indeed, this may be a better name of type 4 data.

More broadly, we propose that the Geospatial Commission works to establish a comprehensive definition of 'Geospatial' that encompasses its full role and contribution. We suggest;

"The term Geospatial encompasses both earth observation using satellites and other remote vehicles and those activities in data analytics using statistical and geographical frameworks, embracing all the new ways of analysis of the associated data, including those undertaken by machine learning and deep learning.

The resulting geospatial information outputs enable improved decision-making in both the public and private sectors and in both the developed world and the global south, leading to better performance and improved use of resources. Good examples can be found in all economic sectors, including health provision, government, transport, financial services, agriculture, construction and in innovative new services; all of which contribute to both improvements in operational efficiency and wealth creation."

Q2. In addition to current government policy, what are the areas of geospatial skills where the Commission could best focus, to help ensure the necessary capability within the UK for the future?

Developing skills is certainly key and this can be best achieved by promoting geospatial as a career path and better explaining what our industry does, beyond core geography.

If the outcome of the Commission is to release a considerable amount of high-quality data as lower/no cost, it is worth noting that there are currently too few people with the skills to utilise it. It is easy to make bad decisions based on poor use of maps and geospatial data. There are of course, undergraduate degree and master's degree courses available for GIS. There existence reflects the level of sophistication required to use geospatial data effectively and responsibly and therefore the Commission can play a role in encouraging and supporting Universities.

The country should nurture Data Science skills (including mathematics, software engineering, data wrangling and business studies). Geospatial extends this skillset into what some now call "Geodata Science".

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The geospatial industry has been "sold" quite poorly in the past. There is a real lack of skilled people who understand both the benefits of the industry and how to explain / sell them to a much wider audience. There are important roles for industry organisations (including RGS, AGI, British Cartographic Society, RSPSoc and BARSC) to play in education. Without education, it is unlikely that releasing geospatial data will generate the yield anticipated by the Commission.

Some of the skills needed in the Earth Observation (EO) sector include:

- Geospatial data analysts and data scientists
- Geographical information system (GIS) experts
- Earth observation data analysts and data scientists
- Earth observation data processing engineers
- Programmers with geospatial data processing expertise

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

While the Commission has been focused on data sets such as OS MasterMap, there is arguably greater value in opening addressing in the form of OS AddressBase. There is of course the complication of other parties, including the Royal Mail and Geoplace. This issue aside, many industry professionals believe open addressing will yield a far bigger return to the UK economy than topographic mapping.

The use of common identifiers would help connect data from contrasting sources, including the six organisations identified by the Commission. This work has already started with the introduction of UPRN, but identifiers also need to be open data so that their use is not limited in any practicable way.

In terms of geospatial data, Northern Ireland should not be forgotten as part of the United Kingdom and its data included.

A wealth of "free and open" historical and current Earth Observation satellite data is available worldwide, notably from the European Union's "Copernicus" programme, from the European Space Agency, and from others such as NASA (USA) and JAXA (Japan). There is also a considerable wealth of commercial satellite data available from suppliers based in Europe, North America and Asia.

Tremendous value can be added to geospatial services by combining terrestrial data sources with satellite data sources which provide long time series, consistently acquired data sets with global footprint.

The challenge for the UK is that it lacks a coordinated data access solution that can bring such data sets together and make them easily and operationally accessible to industry for exploitation. The UK has made some attempts (e.g. via the SEDAS hub at the Satellite Applications Catapult, and the JASMIN facility at STFC RAL) but we would strongly prefer to see the UK take a more holistic approach to this.

The Geospatial Commission can play a key role here in coordinating the UK approach to operational access to a rich variety of satellite Earth Observation data sources, alongside access to other

geospatial information sources, for use by government, industry and research communities in the UK.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

People will always want more; faster and cheaper access to data will drive innovation. It is unclear whether more access will drive revenue for the data supplier. The release of large-scale topographic data without address data is somewhat meaningless. For example, “Here’s a highly detailed digital representation of a building, but we can’t tell you the associated address(es)!”

BS7666 (The national standard for Addressing) was last formally reviewed and amended in 2006. It would be prudent to undertake a new consultation exercise to address stakeholders with the objective of bringing in scope potential new address types and finalizing the feed of address information from third parties such as the emergency services (previously referred to as the candidate process).

One area that may require adjustment within the address standards is that of the BLPU Level/Height information. Currently this is recorded as a text field and is sparsely populated. With the anticipated growth for drones and associated technology it would be helpful to a have a single definitive height associated with a UPRN.

Q6: How should the Commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

Promoting the British Earth Observation (EO) capabilities should be a simple job as we have a wide range of world-leading skills. Our nation’s EO programme should not only utilise satellite but also use HAPS, conventional aircraft and UAV capabilities.

Open access to as much data as possible, in as simple a use format will have a huge impact on the use of the data and the applications that will subsequently be created. The perfect case-study is how Amazon has promoted Landsat data (which has also worked as a tool to promote its Cloud Services)

A hole exists in the promotion of the British EO industry - something that BARSC, for example, is trying to fill - and work must start on promotion in an informative and exciting way, to draw people towards us. This is a huge opportunity.

The UK Space programme is a major concern for a post-Brexit United Kingdom. We have centres of excellence in Space (e.g. Surrey, Harwell and Glasgow). Any loss of access to key European programmes, including Copernicus and Galileo would be a huge set back. An effective geospatial strategy will need to dovetail perfectly with space-based capabilities.

Unleashing the potential of vast amounts of knowledge and data from satellite earth observation and remote sensing into commercially viable geospatial services is also something addressed within the recent ‘Space Data Revolution’ ISCF Wave 3 submission. This programme aims to create a commercial marketplace for EO data, combining with AI to support useful information services across Energy, Transport, Finance and Construction sectors through collaborative R&D resulting in new platforms, products, services and technologies. Should the SDR programme be successful this should also be considered as an important aspect of academia and industry collaboration to support the geospatial Commission in their strategic objectives. The programme is being led jointly between industry, and the UKRI departments of STFC, NERC and I-UK.

Q7. Which new technologies should the Commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The ones that will promote the use of the data, such as Artificial Intelligence. Mass access to data may deliver uses and applications that have not been considered yet (e.g. text messages were only in mobile phones to allow engineers to communicate with each other).

Geospatial and earth observation data is an important input into the UK's expertise in machine vision and AI / Deep Learning. We should like to see a carefully considered strategy from the Commission and not a "make it open and X billion will be added to the UK economy" as a hope-and-prayer. It is questionable as to whether previous rounds of open data had the anticipated benefit and too early to observe whether our European cousins, such as the Netherlands, who have taken an open data approach to their "master level" data have seen a true return. Ensuring that organisations such as Ordnance Survey, and indeed the other key organisations under consideration by the Commission, maintain their high data standards is more important and this can only be done under a long-term funding commitment.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data is central to all future technology such as autonomous cars, 5G, clean energy, and augmented reality. For example, nearly every industry now uses SatNav / GNSS in some part of their value chain (even taxi-cabs, where the availability of geospatial data is what enables Uber to disrupt traditional markets). The essential component ensuring Geospatial Data can fulfil this role is that of Standards – for the data itself, interoperability with other datasets, metadata, data sharing and publication. Data and applications have important roles at various phases of the Define/ Develop/ Test/ Rollout/ Deliver lifecycle including;

- Embed (physical/software) spatial awareness in new tech
- De-risking/prototyping algorithms/services against simulated data
- Development of open testbeds of data, tool suites etc.
- Testing the market/focus-groups
- Determine how geospatial data and applications are being used to support enhanced roll-out of current technologies
- End-user/customer engagement to demonstrate comparable, representative systems
- Allows for continuity of data (i.e. roll out of product)
- Allows for reliability of data
- Allows for higher accessibility – know where the data pertaining to a certain region is

They are also of value in supporting emerging technologies, for example;

- Generation of labelled data from existing systems for Machine Learning
- Increase availability and access to Machine learning platforms, e.g. for local council and public use - supporting and monitoring local planning permissions, up-take of solar panels etc and reduce the need for surveyors
- Real time high accuracy spatial monitoring
- Increase availability of geospatial data, especially high-resolution satellite imagery to apply to machine learning – e.g. change detection from imagery e.g. Coastal erosion monitoring – measure rates of erosion and risk factors for use by the insurance sector

- To enable the creation of geospatial data by wider (non-geo) communities, including developing the understanding of the value of such data and the wider impact sharing such data can have
- Enable historic analysis to look at change over time to enhance the use of older data
- Autonomous Vehicles. The systems these use will benefit from accurate surveys: although they will not be reliant on a 3D model they will be able to more quickly compare the environment to expectations. The same may be true for drone / unmanned aerial vehicles
- Building Information Management Systems. These will become a very important technology in the future (coupled with IoT) since they will enable building owners (and government) to better optimize their efficiency and power usage

More generally, opening up datasets for low cost/free use can encourage and enable the development of new concepts that have yet to be defined or even considered in areas including;

- **Tourism**. Asset-tagging of monuments, buildings, artefacts will increase exponentially, either using Near-Field Communication (NFC) or QR codes to provide details on what is being viewed or visited
- **Asset Maintenance**. Locating and reviewing maintenance information about assets will increase. Everything from air conditioning units, to fire extinguishers to bridges and manholes will be mapped (within BIM when relevant) and asset tagged to allow maintenance schedules to be complied with
- **Navigation**. In-car navigation using geo-tech is well established and being enhanced through information about local points of interest. A similar need exists for all walkers, bikers, runners that use information about statutory and non-statutory paths, terrain (ascent/descent) and points of interest to guide them safely around the countryside

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The Public Sector should continue to manage, develop and maintain existing publicly available geospatial datasets. It also has a key role in;

- Establishing reciprocal data share agreements with other countries/organisations
- Encouraging and financially incentivising UK commercial entities to provide freely available data sets (with standardised interfaces)
- Incentivising the private sector to contribute data by retaining ownership of data as part of contracts let by the public sector
- Providing financial support to private companies who supply geospatial datasets which have more general applications
- Negotiating to license freely available data sets/subsets (c.f. Planet's Open California initiative) via data access portal with API and data standardisation
- Making data more available within and between public sector organisations through platforms, which can also be shared by the private and third sectors
- Partnering with civil society organisations, industry, academia, individuals and other countries on developing best practice, including standards
- Driving best practice and continuous improvement
- Investing more into organisations like GeoVation supporting new businesses using Location Technologies

- Examining and encouraging agile (spiral development approaches) to data management (e.g. SAFe[1])

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Ensure access to high fidelity GPS service (post Brexit). This includes creating infrastructure and services to defend against the increasing threat of spoofing and jamming the service, both from criminals and terrorists.

Standardising the UK approach on indoor positioning, including;

- Investing in the infrastructure so users' location seamlessly transfers from outside to indoor
- Definition of minimum data quality standards
- Standard agreements on data access, licensing and charging
- Driving the development of the platforms / ability to access indoor geolocation data

Further areas for prioritisation and continued/additional investment include;

- Integration of consumer equipment into network for automatic reporting
- Network wide time synching
- Standard asset categorisation and identification
- Standard metadata formats
- Standardised geodetic networks

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The Private sector has an equally vital role as does the Public Sector in ensuring it creates, maintains and improves geospatial data assets that are needed by the UK, working in partnership with Government and other sectors to build mutually beneficial solutions. As part of this role it should;

- Work in partnership with government to develop new data quality and interchange/interoperability standards
- Drive the reduction in cost for maintenance and reflect these savings in lowering prices
- Introduce new technologies for maintaining and accessing data sets
- Work in partnership to introduce new data sources using the expertise in industry, specifically around remote sensing/satellite EO, and IoT
- When government uses the private sector to store data with a geospatial component, ensure that it is available through a geospatial data infrastructure
- Contribute updates when suitably qualified as part of 'normal business', particularly when carrying out surveys
- Encourage startups/incubators etc. towards prototyping/piloting systems before full implementation by established suppliers => Agile at pilot and robust at operational
- Provide support for abstraction wrappers over private sector/commercial legacy systems/datasets

[1] SAFe, the Scaled Agile Framework

- The private (and other) sectors should drive the development and commercialisation of the applications and data to the extent that the infrastructure allows

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

From experience we do face multiple challenges, including;

- Knowing what data is available and how to access it
- Whilst a larger number of datasets are available on data.gov.uk, many are difficult to discover, query and process (and the underlying quality is difficult to assess)
- Different formats, syntax, standards, differing levels of accuracy, maintenance regimes and reliability
- Not always in a computer accessible format/media i.e. PDF vs Excel
- Not aware if data is available through an API
- What the licensing requirements are and how long it may take to get a license (i.e. delays in providing authorisation, due to bureaucracy)
- Constraints to usage that discourage accessing/ using it
- Different set of access/usage for constraints for every dataset

Remedies include;

- Suggest going with a REST interface with Single Sign-on (SSO)
- Introduce simplified geospatial platforms
- Provide Analysis Ready Data (ARD)
- Simplified and Standardised licensing arrangements
- Development/improvement of an international standard like INSPIRE that fulfils the majority of user needs
- Providing clarity and certainty on data quality, availability and freshness making it easier for the private sector to invest in solutions knowing that the underlying data will be available in the future
- MOU's/cooperative agreements between organisations to allow for the development of data and solutions, both over the short and longer term. These agreements could lead to the development of (public and private and third sector) groups that share the cost of data collection or generation (e.g. MoD's Multinational Mapping Co-production Programme)

Regarding the Ordnance Survey specifically, whose data (including OS MasterMap level mapping) represents the gold standard of mapping globally, the issues are;

- Its cost is precluding its use more widely
- As the maintenance schedule is insufficient / uncertain / inconsistent, additional topographic surveys have to be conducted by consultants on behalf of the public sector. These surveys are not shared or managed in a way that allows their re-use. This leads to huge waste when surveys are repeated in the same area

Remedies, which would be hugely beneficial to the UK and save considerable amounts of public sector cost include;

- Reducing the cost of OS products, and/or

- Developing a repository for ALL topographic and aerial imagery data collected and paid for on behalf of the Public Sector for reuse by the Public Sector and if the original contractual conditions allowed, reuse by the private sector

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We see the real value of the Geospatial Commission flowing from it being more than an effective customer for the Public Sector. If its role included enabling other sectors to gain access to Public sector data, support and encourage private sector innovation and was to engage with others to create the wider systems of sharing and collaboration between Public sector and elsewhere, then it would fulfil a truly effective role in the Geospatial ecosystem. To achieve this we see it needing to;

- Fully understand user needs – from private companies in the sector, to government departments
- Understand what data needs to be kept public (not privatised)
- Pool requirements and purchasing (acquire once, use many times enabled by a joined-up IT infrastructure)
- Engage with industry providing a focal point for exchanging problems and solutions. Coordinate and communicate status, needs, solutions, innovations and research across all input and output stakeholders
- Develop a Geospatial Innovation Programme enabling an evidence and experimental approach to data release, quality and access
- Act as a common procurement entity
- Apply common standards (this can help exports)
- Give a clearer sense of strategy to industry to help it develop the next generation of tools
- Help companies sell geospatial solutions overseas by developing the relationship through the Department of International Trade and the international programmes of UKRI
- Understand what data needs constant updating
- Standardise data requirements, format, access mechanisms
- Drive innovation - e.g. workshops
- Define data abstraction mechanisms
- Know what current best practice and state of the art is, then look to see what future systems can bring, so ordering the best product at the best price

The Commission could procure data for the public sector in the knowledge that when it becomes open and available to private sector, there will be opportunities for UK private sector to commercially exploit it.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There are many! The duplication of efforts around data creation and development are staggering, both within and between public sector organisations but with the other sectors as well. The re-use and repurposing of collected and processed data is significantly under developed. Ideas include;

(It may be that some of these listed here are already available and we aren't aware of it, that some are partially available and that others are available but not in easily usable formats or on suitable licensing terms)

- Census findings
- Electoral info
- Air Quality
- Metadata of all available state-provisioned sensors
- Public mobile data – anonymised e.g. accelerometer, GPS & mast tower data
- Social media aggregator
- Public mobile photos – useful in disaster scenarios
- AIS/ADS-B Streams
- Supporting metadata for dynamic data streams e.g. ship MMSI catalogues
- DEFRA/EA data streams (i.e. Environmental Data Exchange portal by the Digital Catapult)
- Open Street Map – use metadata to provide store of government/council resources e.g. libraries, toilets, health services etc.
- Utility companies' services/data feeds
- Rail and Bus companies' services/data feeds
- Road network traffic and camera data
- Post Office & national geocoder and reverse geocoder
- National gazetteer (multilingual)
- Solar Panel Systems locations/capacity/performance
- CCTV
- Regular / fresh EO imagery including VHR and 1m class SAR coverage of the UK (can use used for change detection)
- Adequate access to Copernicus data needs to be secured post-Brexit
- Non-classified imagery acquired by the MOD shared across government

There is also an issue with the ability of the Public Sector to accept or use Geospatial Data that has been collected and generated by private sector firms, on behalf of the Government, for analysis purposes.

Broader collaboration, outside of established contracts, through MoUs, Collaborative agreements, communities of interest would also be of assistance.

Regarding access – the same issues and remedies listed in our answers to Question 12 apply.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

It would seem sensible to work with what already exists, rather than starting completely afresh, therefore taking a co-ordinated approach to the strategy, with each DA creating their own around an agreed central spine seems appropriate. There are however certain components that should be centrally agreed, to ensure compatible access to data across the whole of Great Britain and NI (and indeed the other jurisdictions such as the Channel Islands and the Isle of Man). These include;

- Common Standards (using existing International standards) for data, metadata and services associated with access to the data
- Common data formats, themes, feature definitions

- Shared and consistent access platforms – not centralised repositories, but a Clearing House or data catalogue concept
- Pricing and licensing – a common strategy covering the whole of the Great Britain and NI, so making it easier and simpler to obtain and use data
- Common Governance process for updating and changing the above over time

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

To help ensure coordination and sharing of best practice among local authorities, the Geospatial Commission could establish some key themes that would attract participation and representation from the local authorities. In collaborative discussions and meetings, the local authorities often identify collective issues and solutions. Unfortunately, the local authorities are under resourced and therefore the Geospatial Commission will need to have those key themes to ensure engagement with others regarding their geospatial priorities.

The benefits of having a formal standard for recording and sharing this information can be seen by the impact of introducing BS7666, the national standard for addressing in GB. This has enabled the proliferation of multiple solutions that conform to this to be generated and supplied to the public sector. It has helped form a truly competitive market place and not a fabricated one dominated by monopolies.

Organisations large and small have built innovative solutions that drive down costs and improve efficiencies. The adherence to a standard also means a public sector organisation is not dependent on one solution/supplier. This is essential for competition to work. If a better solution is available, this can be adopted without compromising the whole operation of the organisation. A common standard for location intelligence information described above can have the same catalytic effect, benefiting public safety without overburdening the tax payer.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

There are many innovations in the public and private sector that have a geospatial element, and we can anticipate many more in the future. These include healthcare and social services for aging populations, connecting geospatial content to the internet of things technology, routing and transport for goods and people, or services for the financial sector.

As a specific example, there is no common dataset across the country which captures what is on the road. For example, speed limits, parking restrictions, crossing points etc. This is likely to become more important with the introduction of autonomous vehicles.

Q18: Are there any other areas that we should look at as a priority?

We should like to see remote sensing and Earth Observation represented as a priority area for geospatial within the Geospatial Commission. As data analytics and applications integrate satellite, UAV and other data, we would like the Geospatial Commission to ensure that it is capturing this capability as part of the geospatial story. Given the cross government uses of remote sensing, we've never achieved a solid UK strategy for this capability – the Geospatial Commission is uniquely positioned to take some leadership responsibility and help achieve better development and procurement of such services by the public sector.

One area that has been discussed before is the opening up of address data and remove the IP barriers that exist when using this dataset. It is widely accepted that the address data has significant importance and value to the economy. Not only does it serve to act as the foundation for service provision throughout the public and private sector, it is one geospatial dataset that is widely recognised by the public.

According to the white paper issued by the Open Addresses project (https://www.scribd.com/document/265440465/Open-Addresses-the-story-so-far#download)

"A 2012 report from the PAF Advisory Board estimated its value to the UK economy to be between £992m - £1.32bn each year. In 2002, the Danish Government made its national address file available for free. Since then it has calculated its direct financial benefits to cost ratio at 30 to 1. By 2010, the year in which their report was published, they estimated the direct benefits of free address data to the Danish population to be around EUR 14m, with costs of EUR 0.2m. Scaling to the UK population, this would be an annual benefit of around £110m. In their 2014 report for the Department of Business, Innovation & Skills, Katalysis recognised the need for Open National Address dataset: "UK society relies heavily on address data and current products have helped greatly to create benefit. The review has determined that Open usage would result in substantial and valuable growth among new user types and with even greater community benefit. The recommendation is that a basic address product should be free to all users at the point of use."

Another area in which work could be implemented to help ensure value from geospatial datasets available is to centralize and improve the accuracy of a national data catalog or ClearingHouse. In many situations a dataset may already exist, collated and maintained by an organization but it may not be readily apparent to a potential consumer of that data. A national data catalog referencing the existence, license type, accuracy, provenance, metadata of datasets would help increase the utilization of datasets throughout the UK.

As data analytics and applications that integrate satellite, drones, high altitude platforms and other data emerge and evolve, along with complementing big data technologies like artificial intelligence and machine learning, the Geospatial Commission should ensure that these vital capabilities (in which the UK has excellent heritage) are clearly adopted and exploited as part of the national geospatial strategy.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are countless public and private sector innovations that have a geospatial element, and we can anticipate many more in the future. These include healthcare and social services for aging populations, connecting geospatial content to the internet of things technology, routing and transport for goods and people, or services for the financial sector.

Some of these innovations will have particular regulatory challenges that will need to be addressed, however, at this stage we need to work on the regulatory challenges of the data feeds themselves. For example, we need to see more open data that enables geospatial innovations and the UK government needs to establish its regulatory framework for how Earth Observation data from UK satellites can be distributed commercially.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Establishing the Geospatial Commission is an excellent first step for demonstrating the UK's presence internationally.

The UK has a very sophisticated and, despite the many issues, a very efficient geospatial ecosystem. We take many things for granted because of our geospatial heritage. The benefits from this experience simply do not exist in most countries in the world. The UK has the standards, technology and business processes to support geospatial use in both the public and private sectors. This can become a huge revenue source for the country if deployed across the world.

The contributors to this ecosystem are many, they vary considerably in size and international presence. Currently each contributor has to make their own efforts to reach out to the international market. This effort is considerable and often prohibitively so for most. It is also often completely uncoordinated. The benefits of systems, standards and processes that work seamlessly together is often lost when looked at in isolation. Given the huge logistical issues with doing business abroad it will be very useful to work in a more coordinated fashion with government assistance where necessary.

A geospatial sector specific initiative that promotes an overall business solution abroad and sponsored by the government would be very useful. The focus should be on overall solutions to business / economic issues helped by geospatial solutions rather than the technology. This can be set up and coordinated by leaders in the geospatial industry. This should be focused at specific countries where current initiatives are being planned. We need the DIT people on the ground to be briefed on the things to look for and highlight them early so early intervention by geospatial experts can take place. There also needs to be an emphasis on solutions that deliver benefit rather just strategies that a nation can adopt.

This coordinated approach with the help of the government can help realise currently untapped geospatial potential in the UK.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There are several examples. Australia in particular is progressing highly effectively through the leadership of Geoscience Australia, an organisation that is implementing best practice and joining up effectively with new capability. The Nordics and the Netherlands have approaches that are worth looking at. China and South Korea are known to be doing a lot in this area, however information is limited.

Mexico is an innovator in this field – it has established an over-arching organisation organisation called INEGI to manage all geospatial information for the country.

Beyond consideration of best practice in public sector delivery of geospatial, we should consider best practice in the private sector and identify areas where we can better integrate advances in the private sector. With their extensive membership, the OGC could provide an excellent service here for ensuring an efficient and joined up approach with commercial capabilities.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Surrey Satellite Technology Ltd
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	Please mark with a X
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	

Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Remote sensing - understanding of capability and performance of sensors and interpretation of resulting imagery/data
- Image processing/data science – manipulation of, and extraction of information from, Earth observation and geospatial data
- Statistical skills – extracting meaningful trends from geospatial information

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Skill gaps:
- Remote Sensing - understanding of capability and performance of Earth observation sensors and interpretation of resulting imagery/data
- Image processing/data science – manipulation of, and extraction of information from, Earth observation and geospatial data

How can these be addressed:
- Recruitment from relevant graduate and post-graduate courses
- Specific training
- Collaboration with academia/other experts
- Wider education of available careers in the geospatial sector

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Datasets e.g.
- Global satellite AIS/ADS-B
- Land cover/land use data
- Meteorological records – e.g. cloud cover, rainfall
- Dynamic traffic information

Although some of this information is available, historical data is not always accessible and the format is not always useful – e.g. bitmaps and PDFs rather than data that can be manipulated

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

SSTL recommends that the UK develops its sovereign Earth Observation capability, either to complement the Sentinel data or to ensure access to Sentinel-equivalent data following Brexit (if Copernicus open access policy reconsidered in future). Current gaps in Sentinel offerings:

- High temporal resolution - this could be achieved through a sovereign constellation of small satellites
- High fidelity, high resolution optical imagery
- High fidelity, high resolution SAR imagery – to complement NovaSAR
- Non optical – AIS/ADS-B
- Super/Hyper-spectral imagery
- HAPS/UAVS for continuous monitoring of key areas of interest

Provide access to data through hub which delivers analysis ready data (i.e. pre-processing already performed – e.g. atmospheric, geospatial correction)

Increase global UK ground station network – e.g. sovereign territories – to improve timeliness

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Nationwide comms network (5G/WiFi) – to enable delivery of data/information from location – e.g. remote monitoring stations

On-board operations/autonomy

Inter Satellite comms (LEO-GEO-GS, intra-constellation – to enable rapid satellite tasking and data dissemination)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Potential use of existing data:

- De-risking/prototyping algorithms/services against simulated data
- Generation of labelled data from existing systems for Machine Learning
- End-user/customer engagement to demonstrate comparable, representative systems
- Testing the market/focus-groups
- Open up older archive data for low cost/free use
- Development of open testbeds of data, tool suites etc.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Potential options for public sector involvement:

- Reciprocal data share agreements with other countries/organisations
- Encouragement/incentivisation of UK commercial entities to provide freely available data sets (with standardised interfaces)
- Freely available data sets/subsets (c.f. Planet's Open California initiative) via data access portal with API and data standardisation

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Priority geospatial infrastructure:

- Ensure access to high fidelity GPS service (post Brexit)
- Standardising UK approach on indoor positioning
- Definition of minimum data quality standards
- Standard agreements on data access, licensing and charging
- Reliable city and country wide comms networks (WiFi/IOT/LoraWAN/5G networks) for access to available data/information
- Integration of consumer equipment into network for automatic reporting
- Network wide time synching
- Standard asset categorisation and identification
- Standard metadata format
- Standard geospatial reference frameworks

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Incentives (e.g. tax breaks/grants) to encourage release/utilisation of private sector/commercial assets and data into infrastructure

Encourage startups/incubators etc. towards prototyping/piloting systems before full implementation by established suppliers => Agile at pilot and robust at operational

Support for abstraction wrappers over private sector/commercial legacy systems/datasets

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges in using geospatial data

- Knowing what data is available and how to access it
- Different formats & syntax
- Not always in a computer accessible format/media i.e. PDF vs Excel
- Not always available through an API?
- Licensing and timeliness (i.e. delay to provide authorisation due to bureaucracy) constraints to access
- constraints to usage that discourage accessing/ using it
- Different sets of access/usage for constraints for every data set
- Accuracy, level of maintenance and reliability unknown?

Potential remedies

- Suggest going with a REST interface with Single Sign-on (SSO)
- Provision of Analysis Ready Data
- Simplified and Standardised licensing arrangements
- Standard access mechanisms

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Standardise data requirements, format, access mechanisms

Drive innovation - e.g. workshops

Coordinate and communicate status, needs, solutions, innovations and research across all input and output stakeholders

Define abstraction mechanisms

Provide education on availability and use of datasets

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Additional datasets of benefit:

- Regular EO imagery including high resolution optical and SAR coverage of the UK
- Adequate access to Copernicus data post-Brexit
- Census findings
- Electoral info
- Air Quality
- Metadata of all available state-provisioned sensors
- Public mobile data – anonymised e.g. accelerometer, GPS & mast tower data
- Social media aggregator
- Public mobile photos – useful in disaster scenarios
- AIS/ADS-B Streams
- Supporting metadata for dynamic data streams e.g. ship MMSI catalogues
- DEFRA/EA data streams (i.e. Environmental Data Exchange portal by the Digital Catapult)
- Open Street Map – use metadata to provide store of government/council resources e.g. libraries, toilets, health services etc.
- Utility companies' services/data feeds
- Rail and Bus companies' services/data feeds
- Road network traffic and camera data
- Post Office & national geocoder and reverse geocoder
- National gazetteer (multilingual)
- Solar Panel Systems locations/capacity/performance
- CCTV

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q17: Are there any other areas that we should look at as a priority?

Earth Observation – ensuring the UK has access to existing datasets (e.g. Copernicus) now and in the future and developing a strategy for providing access to new and enhanced datasets in the future.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

A UK Earth Observation Data Policy is urgently required to govern, for example, export restrictions associated with imagery data, to facilitate commercial activities of satellite manufacturers and data providers.

Sales opportunities for SSTL have been lost because of the lack of this policy.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Organisation	Survey4BIM
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

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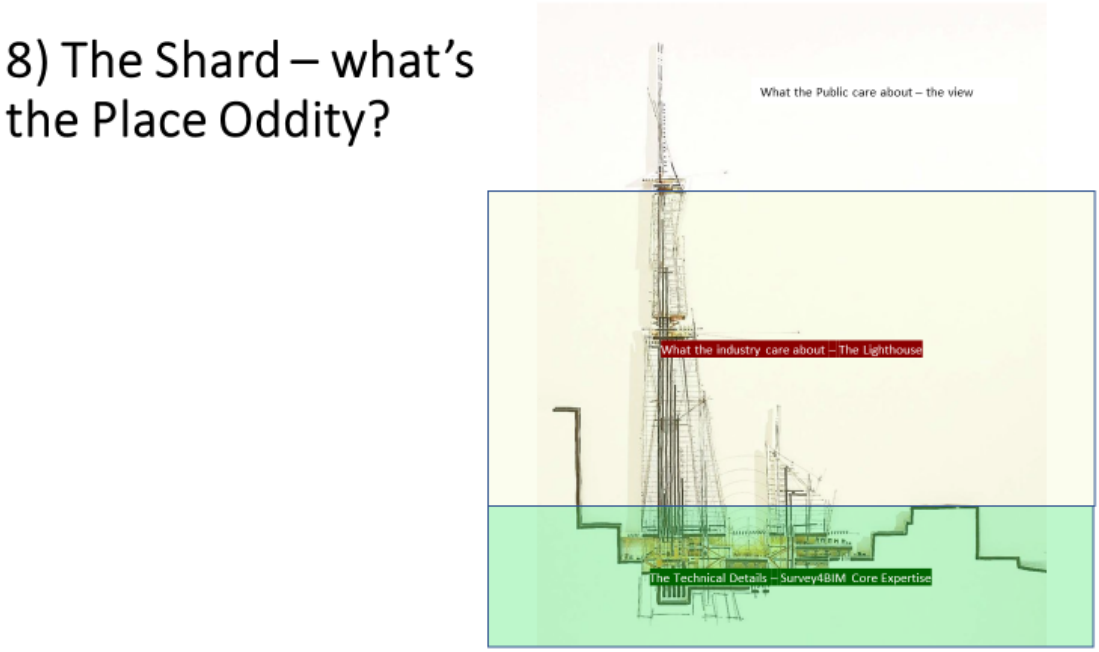
The survey industry is a small industry with few people wearing many hats. With this in mind we endorse and do not want to repeat the input you have received from the Chartered Institution of Civil Engineering Surveyors.

However, we would like to add that we want to ensure that there are some basic principles that we would want followed with the use of Geospatial data – that is primarily – **People First.** We are in favour of Smart Cities, of which the foundation is Geospatial, but we are acutely aware that we run the risk of getting lost in the detail and over focused on technology for technologies sake.

With that in mind, I would like to explain the following slide from one of our recent engagement presentations.



The aim of Survey4BIM is to deal and talk in "Space & Time". After all everything comes down to particles and how they change over time. The clever part is understanding relationships between particles, analyzing how they change and enabling infrastructure to respond accordingly to ensure that smart buildings, that make up smart cities, work for the population.

To make this clear – The public care about the view from the top of the Shard, they care about how amazingly fast the lifts are and that they work 100%, they might care to know that even on the top floor there is a public convenience (that they do not have access to).

Survey4BIM's industry peers care about the structure the enables the public to use the facility, and that everything fits together, and functions as designed. They should care about a digital twin to modernize their Facilities Management capabilities.

Survey4BIM are totally focused on putting the shard in the right place, maintaining that place information over time and keeping that base map information up to date and timely.

After all, it's all location, location, location!

And so, I hope this helps explain why I will not fill in the answers to rest of the questions, as the answer to all questions is do the right thing, **people first.**

[Text Redacted]

Call for evidence - three key themes

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Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

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Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

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Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

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- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Other - please state	**Professional Working Group**

We would like to emphasise that the use of public geospatial data is primarily to empower p**eople first.**

We are in favour of Smart Cities, of which the foundation we believe is a Geospatial Digital Twin. But we are acutely aware that we run the risk of getting lost in the corporate exploitation of data over the societal ownership and benefits of wider context national geospatial mapping and a digital twin could bring. We believe the Geospatial Commission can play a leading role in ensuring the UK brings the benefits of geospatial data to all its citizens. As such our responses represent a wide spectrum of geospatial professionals who care about the profession and its contribution. We support in parallel the submission by the RICS and ICES but believe as an open forum of volunteers who are interested in the success of the geospatial profession in society we can offer some unique and insightful contributions to your call to evidence and goals.

Yours sincerely
Survey4BIM Committee

Survey4bim.wordpress.com

Call for evidence - three key themes

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1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We suggest you should add Geospatial platforms
- like Google maps - the platforms that allow geospatial data to be visualized and interpreted and added to with the content of users who may offer their services. Google offers this with formats such as KMZ and commercial services. The UK geospatial commission could provide a more innovative and accessible platform for more precise UK datasets

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The Professions and professional competency across core spatial professions (Remote Sensing, Land, Hydrographic and Engineering Surveying) and related professions (Geography , Computing, Logistics, Architecture, Planning, Building, Environmental Science) being enhanced, reinforced and upgraded for a digital age.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Lack of professional recognition within organization for Information Management and Geospatial Leads,

Many large organisations these leads are completely missing - passed to related Engineering groups not specialised in geospatial skills, or just completely ignored with lack of lessons learnt or complete gaps in spatial awareness and accuracy of information. Organisations such as Network Rail have no head of Geospatial Data although they collect and use vast quantities of such data.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

OS master map, Utility Records and Land registry offer the greatest base value for building a platform for future capability and services analysis as well as a market for continuous update and improvement of geo-spatial data sets.

At many different levels these three datasets provide the backdrop for reviewing resource and investment needs and outcomes for many businesses and social services and policies - they fundamental form the basis of a national digital twin, spatial strategy and platform for smart infrastructure and policy / decision making, as well as public accountability and transparency for resource allocation

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Certainly - increasing services transactions and users are interested in their people and dynamic asset point locations - not static object point locations.
With the exception of coordinates (which are difficult to use as none specialists) there are limited ways to point locate, thus limiting interaction and exchange - referencing systems like What Three Words eliminate the risks posed by wide area or non-specific location referencing (i.e. streets which are very long and lack physical building numbers, post codes which are geospatially too large (up to 80km2) and risk mis-location (as happened in the Olympic Park with a heart attack victim and Ambulance miscommunication).
Equally organisations may like to overlay their own asset location systems (like Railway Engineer Line References and mileages) to assist access and inventory management of key assets and supply chain / stakeholder engagement. So summary organisations should be allowed to add new ones

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

This relates to platforms and data originating coding (so it's source organisation can be traced and credited with sharing (or royalty payments9. The UK needs data repositories and tools to share and disseminate data via controlled platforms and traceability of capturer.

Secondly the UK needs to understand that there are 2 digital Twins - A Capacity Model (design and theoretical) and a Performance model (reality / as-built). The former is very structured, logical and defined by discrete elements and activities / functionality which are intended and detailed (i.e. roads and junctions, buildings and service networks) the later is continually changing and required for discrete change measurement or aggregation (car movements , earth movements , water flooding etc, distortion of man made and natural resources and assets).
The short term storage capacity needs to be high volume, but long term can be substantially lower based on change / aggregation analysis (i.e. the difference to the capacity model)
It is the rapid processing, dissemination and analysis of geospatial data that represents the real challenge - not the static storage - this can be solved by automation and inexpensive storage systems for retrieval , archive and replacement with updates

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Platform technologies and data dissemination and sharing
Processing technologies
Data transformation tools (grids, formats , metadata standards)
Visualisation and spatial analysis tools

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Sensor miniaturization and accuracy improvement via increased spatial reference systems infrastructure and communications (continuous, integrity based, augmented systems such as cameras, Wi-Fi, internal, GNSS network densification (Galileo) and on the fly ad-hic networks (phone, IOT, scada, vehicle sensors) for indoor and urban canyon scenarios

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Provide national supported / mandated datasets (i.e. EA flood mapping, OS maps, Land Registry Maps),
Allow commercial partnerships and export capability freedom for organisations providing public mapping
Preferential treatment for Innovation funding and hub / training provision (like the Geovation Hub in London or conferences and open engagement events,
Tax breaks/ recovery for sharing data with public bodies,
Block chain data organization tracking for licensing / royalty recovery over certain use / purposes - i.e. like technology recovery licensing and royalty arrangements for mobile phones and computers or the music industry

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

OS CORRS, Satellite and Cartesian reference frame verification - densified in cities and non-open sky areas will support geospatial use
 - increased wifi and 4/5 G availability
- Platform hosting technologies for large geospatial datasets and data marts

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector engagement should start with franchised utilities and infrastructure businesses who should support a Smart Infrastructure model and upgrade their systems to provide 3D digital data and logic for their systems geospatially – private sector bodies who already enjoy public asset of market sector dominance via franchise.

The commissioned should include trade body SME representation and professional body representation , along with major stakeholder organisations

Academic institutes and innovation centres should be supported with preferential access, even if privately owned – subject to data originator traceability and recovery

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Firstly the release of data in digital formats which are directly consumable in geospatial systems (objects / vectors),
Secondly the 3D management of data (2D is extremely limiting),
Thirdly the reference frame conversion of data needs to be accurate (ETRS89 Cartesian is the core requirement for single point location, coupled with accuracy value attributes) and tools for this need to be support for smaller firms and innovators in service provision (so they don't distort geospatial referencing

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Register and manage partners and provide blockchain licensing codes,
Be responsible for advising government on public sector bodies, and public sector issued franchise utility and services license (wifi),
Own the digital twin geospatial model for the state and maintain a platform for access, sharing and innovation for all interested and registered partners (in collaboration with the strategic government agencies
Market UK Geospatial Showcases world wide

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

Services, Utilities and Transport Infrastructure models are key overlays for a smart infrastructure model and capacity models.

Parks and public services asset models could also add significant value.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Base content can be agreed, but user overlays can vary significantly by regions , as well as partnership and innovation initiatives.
Agreed common access sharing and pricing for large organisation sharing and use of their datasets if added to the portal (based on regional agreements on publications – regions deciding what can go on the publicly accessible data platform
Agreed security protocols with sensible risk appetite based on already accessible datasets (i.e. google maps / earth)

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

LIst all organisations geospatial datasets ownership and set accessibility partner levels and pricing recovery models
Provide reports and case study on benefits and returns, and user access and sharing by dataset and organisation
Allow user feedback on data quality and benefits / issues

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Capability model for people (safety, sales, crowd mapping, concerts), vehicle (work, private and public) and utilities and transport networks

Q18: Are there any other areas that we should look at as a priority?

Utility models - power, sewer, water, telecoms

3D upgrade of Land Reg and OS data
Addition of recognised accuracy attribute
Creation of geospatial platform for digital twin
Tools for grid conversion and registration of data originators and sharers
Wifi and wired reference frame infrastructure

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Web based location services,
Asset management tools - businesses modelling their assets and capability
Social resources and planning tools - local authority and investment tools
Utilities and franchises services data sharing requirements and capacity modelling
Risk modelling and resilience

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Create a UK digital twin and the platform / ecosystem to control sharing, innovate and commercialisation geospatial data for capability, capacity and future prediction of social and economic activities

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Google Earth and Maps
Dutch Land registry Model,
New Istanbul Integrated City Model
Singapore transport model
Munich and Toronto City Models

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About you and your organisation

Name	[Text redacted]
Organisation	Tapestry Innovation Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Micro business (up to 9 - and building strategic alliances)	**X**

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q18: Are there any other areas that we should look at as a priority?

It's exciting to hear that the UK government is to proactively support and fund innovation within the geospatial sector. An opportunity to shape new futures, solve both environmental and public problems and create new markets. An opportunity to harness human creativity across communities and countries.

My brief consultation contribution will focus on the benefits of taking a new 'whole system' and 'triple bottom line' approach to geospatial data to facilitate the co-creation of community wellbeing.

By a 'whole system' approach I mean that by combining and publishing place-based data sets across different themes, citizens can get a much more comprehensive view of their local neighbourhood, and by a 'triple bottom line' approach I mean the opportunity to deliver every place-based intervention, product or service maximising social, environmental and economic growth.

New approaches to location data and (totally accessible) information will need to be facilitated by a new standards framework for near real time comparisons on different interventions in different geographies - and the sharing of good practice within a new culture of transparent peer-based learning, experimentation and continuous innovation.

The world's leading climate scientists have warned us that there is only twelve years for global warming to be kept to a maximum of 1.5C, beyond which even half a degree will significantly worsen the risks of drought, floods, extreme heat and poverty for hundreds of millions of people. And as we know our urgent social challenges also cover mental health, inequality, obesity, loneliness and aging societies.

For the first time in 15 years the UK government has released a new Civil Society Strategy with a strapline of "People, Place, Partnership" advocating a new culture of cross sector collaboration within 'places'. Place leaders will need comprehensive location information as part of their operating toolkit as they work on the necessary institutional and individual behaviour changes within a new devolved collaborative culture. With both data transparency and accessibility key to improving productivity.

So, in summary a new proactive and holistic focus on geospatial data is exciting because it has the potential to support place-based creativity, co-ordination and co-operation for change – growth that is outcome focussed, smart and inclusive.

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	TARMAC
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	√
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

There is a large focus upon economic growth, however the environmental potential is wide ranging. Flood prevention, pollution, monitoring of protected species such as bats and monitoring landslide risk are all areas well suited to geospatial data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Regulation and training for the use of UAV equipment should be promoted more strongly.

In addition, software technology to process these large datasets needs to be fostered.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As mentioned in Q2, the use of UAVs is currently not well understood by either hobbyists or the industry. Responsible use and better understanding of how to capture quality data need to be promoted. British companies creating the equipment and processing technologies should also be stimulated.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

In England and Wales, LIDAR (laser-based topographic surveys) are currently freely available via the Environment Agency. This data is patchy at best, and is not available at all in Scotland due to poorly planned copyright reasons. It is essential that the dataset be bolstered and made more freely available. An example of where this would be effectively used would be in flood prevention and flood risk assessment.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Question unclear.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Continued contribution to the European space agency and access to the Galileo programme are essential for the UK to further our capability. These issues of science should not be as highly politicised.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Ground and UAV based photogrametry and orthophotography, as well as LiDAR technology are advancing very rapidly. They are becoming more detailed and accurate.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Automation (whether of automobiles, agricultural equipment, or military, will rely upon an accurate baseline geospatial dataset.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

As mentioned in Q4, controlling copyright of any data gathered for the public sector is essential to foster its wider use.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Continued contribution to the European space agency and access to the Galileo programme.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Data should be shared wherever possible. For example, the British Geological Survey already runs a system where data can be sent to them for curation and sharing on platforms such as iGeology. This is largely in place for sub-surface data at present, but the approach should be taken for surficial and aerial data also.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

See answer to Q4.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Publicity is key. Indeed, I myself only heard about this call for evidence at a conference.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

http://mapapps.bgs.ac.uk/geologyofbritain/home.html

An HTML5 viewer (which can be used on almost any computer or smartphone) is an effective format. The example above is very effective. Geological data on the whole UK. There is also an AR app displaying the same data.

Another example is the Environment Agency flood risk data portal.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The question itself is something of a paradox. This approach lead to the issue explained in the answer to Q4. I do not believe that there is a practical need for regional variation when it comes to scientific data.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Better alignment of other systems, outside of geospatial data, would help to foster this. Subjectively, however, cross-regional training of public servants to try and get them to the same level of expertise when it comes to geospatial data would be a good start.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

GIS applications as a means of displaying, analysing and sharing geospatial data would be an effective vehicle for many of these topics. In tarmac, for example. We run a “Land Information System”. This is a GIS which contains company ownership boundaries, planning information, documents, local authority boundaries, geological information, etc. Any data can be pulled together in such a system, as long as it has coordinates. Effective collation and curatorship of geospatial data will ensure that it is more widely used.

Q18: Are there any other areas that we should look at as a priority?

The UK mineral planning strategy.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

See answer to Q8.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

With contributions to international initiatives, such as Horizon 2020 and its successors, the European space agency, access to the Galileo and educational programmes such as Erasmus.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

https://what3words.com/partner/mongol-post/

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	Telespazio VEGA UK Ltd
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
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Central government	
Charity or social enterprise	
Individual	
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Local government	
Large business (over 250 staff)	**X**
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Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We agree but would recommend that the "Positional data" should be considered Thematic Data, with its positional information given by the geospatial identifier. For example crime statistics for a ward are Thematic data, and the positional information of the ward given by the geospatial identifier.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Key themes such as open data, security of data, data quality assurance, data standards and privacy. These issues are enablers to growth in the geospatial data sector

The make up of UK's Geospatial and Earth Observation specialist resource pool is cosmopolitan. It would not be surprising to find the UK with a Brexit-related skills shortages in the short term. Ensuring that Geographic Information and Data Science skills are highly positioned in any future home office immigration strategy would be welcomed.

Positioning (i.e. navigation) competence is poorly represented and poorly supported nationally compared with competing states. For all mobility applications and for many infrastructure & construction applications, the positioning and movement of vehicles and assets is vital. UK government should consider strengthening both governmental and UK industrial relative weakness in positioning technology, or risk foreign competition securing the majority of industrial growth in mobility (land vehicle, autonomous vehicle, RPAS, aircraft, shipping) applications and services.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Cabinet could ensure that the Home Office prioritises Geospatial, Earth Observation, GNSS and positioning specialists as part of any post-Brexit immigration policy.

As new technologies become ever more commonplace, it is essential to ensure that the students have a broad enough education such that candidates for employment could more often have both geospatial and AI/machine learning knowledge. There should not be situations where an geospatial organisation has to choose to employ an AI or geospatial focused candidate for lack of both skills in one person.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Cabinet Office could lead the charge with discoverable APIs of publicly-held datasets and shift the focus away from data downloads and/or portal (WebGIS) viewers.

Further examples of data that could be made available for the public good are data that are held by NERC/universities for academic use. A specific example encountered by the author was access to Level1-3 of the NERC British Isles

continuous GNSS Facility GNSS observations data which at the time of writing is accessible only by academics. Entities in the private sector can only access lower level data which needs specialist software to make the data useful for geospatial applications.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Reverse address lookup (from geographic location to address/postcode) would be particularly useful for AI technologies which are identifying behaviours on geographic locations and wanting to tag the behaviour change detected to addresses.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The commission should align with the approach taken in the UKspace sector bid and Industrial Strategy Challenge Fund proposal (data refinery). Further to this, the advantages of near real time data should be maximised leveraging upon existing investments made such as the COSMO-SkyMed User Terminal for NRT data access.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Deep Learning approaches applied to distributed multiple sources of geospatial data. Access to computing resource via cloud computing is now at a level where previously unforeseen geospatial co-analysis of an entire nation's geospatial data is possible.

Positioning and guidance technologies, route optimisation, integrity and robustness of positioning for critical applications are essential technological elements in the exploitation geospatial data.

It should also be noted that pace of development is such that legislation needs also to evolve at the same pace to navigate and guide the trends and interactions between technology and people with respect to: blockchains, gig economy, IoT and their inherent spatial constituents.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Remote monitoring operational services through combined Earth Observation platforms, software, analytics and IT infrastructure. These may provide automated alerts for technical specialists to appropriately triage, react to and guide subsequent human interventions in areas where human "boots on the ground" surveys are the only method available at present.
Future applications of VR/AR/immersive technology could build novel applications based upon the use and translation of multiple geospatial data – existing "baseline" data with NRT analytics.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Funding is a key issue, and taking on new investment on an organisation by organisation basis is very difficult. However, there are fundamental datasets, especially ones derived from satellite analytics that would have multi-agency benefits. A concept of subscription by the organisations to efficiently fund the maintenance and new national datasets would reduce the overall cost to Government, reduce silos and reduce duplication of effort/procurement.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

It is essential that the UK stays in the EU space programmes Copernicus and Galileo.
“Downstream” positioning technologies including GNSS, Indoor beacons & technologies, Inertial systems, and machine vision technologies are crucial elements. The integration of these technologies is immature for most markets and will bring substantial benefits to performance as well as robustness against threats. “Downstream” technologies are the engines of economic growth, and in turn depend on investments in “Upstream” State-funded systems like GPS, Galileo, and perhaps UK GNSS.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

The private sector are experts in this field and should be the go-to with respect to fulfilment of government infrastructures that underpin geospatial services. Having this approach will also allow further benefits to be realised to the UK economy, as entrusting this to industry would mean that the UK industrial capability would be further developed and the approaches/solutions employed would have significant export potential to those countries with lower geospatial readiness.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Adopting existing standards (OGC, BSI or otherwise) that serves a wide cross-sectoral need, publish to it, expand it if required, and publish the extensions with a standards agency to allow other public and private bodies to mirror use of the updated standard. This will help ensure that metadata is complete and the data ready to use, without the need to contact the dataset’s originator for further guidance.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission could encourage the public sector partners to align around a common strategy. It could also act as a requirement broker and match multi-agency needs against effective country-wide data set and capabilities available from industry. Also in reverse, by having a good understanding of the industry capabilities across broad data themes, it should be able to help connect the benefits of such data purchases to the maximum number of public sector users.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Rural Payments Agency collects a variety of satellite and aerial imagery to support its activity in the efficient payments of farming and rural payments. The classification datasets and indeed the underlying imagery could have significant value for planning, local government and other environmental management functions.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

The Commission needs to have the resources to enable its partners to work together. Creating new collaborations and initiatives does not come free and many similar initiatives have failed in the past due to lack of government funding and a lack of willingness to change organisational structures. Regional variations in priority will determine the activities ongoing and planned next, but the commission could capture the longer term strategy of each region as well as elements that could be added when taking a whole UK approach.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

From the devolved administrations to local authority level the commission could establish a network of lead geospatial practitioners and their identified thematic application areas and utilise modern communication methods to hold on-line best practice sharing activities for the network of practitioners focused on the same thematic. A geospatial commission lead per thematic could develop the experiences shown into a national best-practice on-line resource to allow learnings of disparate groups to be shared and easily accessed.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

The benefits of using remote monitoring techniques from satellite, aircraft and drone for major infrastructure projects has been proven and could become an industry standard requirement. The extensive image archives that exist across the UK means EO data can provide monitoring services for pre, during and post construction. Datasets such as ground deformation, monthly ground cover change, flood mapping would have application to many of the identified categories (property and land, infrastructure and construction, natural resources).

Q18: Are there any other areas that we should look at as a priority?

EO services to the Maritime sector are relatively mature compared to other sectors and include:

- Ship tracking using satellite AIS and Synthetic Aperture Radar (SAR). Used for monitoring activity around sensitive sites and for combating illegal fishing
- Oil spill detection using SAR – a service that is used by the European Maritime Safety Agency

Emergency and Natural Disaster Response. EO data provides up to date information on flooding, landslides, storm damage and other events that impact on the environment. Having a UK ground station infrastructure offers the capability to receive satellite data in near real time and provide fit for purpose services to the first responder community.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Persuading industries to adopt new services that utilise EO data requires a level of trust to be built in the technology, and proof that concepts work and regulatory standards have been met. Examples include services that monitor Critical National Infrastructure assets in sectors such as transport and energy.

In the case of transport, and rail in particular, “Moving block signalling” as a replacement for “fixed-block” has the potential to increase rail capacity by 50% on exiting rail infrastructure. Rail regulation and standardisation is notoriously complex and slow, and Governmental support to unblock regulatory blocks would be helpful.

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

The commission should encourage international collaboration and inter government agreements to share data (for example from national EO missions).

Whilst geospatial data (UK government's traditional focus) is developed and maintained nationally, positioning systems that use and exploit that data are international. Successful industries that provide positioning technologies, applications and services are all international. Deeper governmental support for development of positioning technologies would be a powerful engine for growth and international engagement.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

A starting point is the Digital Economy and Society Index https://ec.europa.eu/digital-single-market/en/desi. This suggests Denmark, Sweden, Finland, and the Netherlands have the most advanced digital economies in the EU and lessons could be learned from these countries.
The US are clear leaders in GNSS technologies, and many other positioning technologies too. The US has also led the world on providing open access to dataset collected for the public good. Belgium are an exemplar European state to have significantly benefited from investments in the Galileo system in terms of creating downstream businesses fit for economic growth and exploitation.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Terrafirma Mine Searches Ltd.
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	X
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

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2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes, I agree with the general principles.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Focus on physical-to-digital data capture techniques: Digitisation of hard copy archive material into GIS. Investment in and exposure of machine learning to help achieve this.

Streamlining/combining various addressing datasets into a single offering.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We currently have in-house GIS expertise but as above, we'd like to possess the skills to enable machine-learning and map recognition techniques. Through government driven digitisation programs that employ these techniques, we could access or purchase the end product instead.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Digitised historic mapping archives held by OS and the BGS would be of great value to us. There exists hundreds of OS maps from the 19th and early 20th century which contain extensive geospatial information. When these features (such as mine shafts, wells, coal seams) are recognised and converted to GIS format, a Historic Landuse Database (HLUD) is created.

Armed with an HLUD, we could realise the full extent of mining history across the UK and assign appropriate risk ratings to properties without manually interpreting historic maps.

The OS licence a small number of commercial organisations to sub-licence access to the historic maps. Through this route, the cost of a map pack for a given site can run into hundreds of pounds – a prohibitive cost. We believe OS should release an HLUD as a competitively priced product, or at least open access to the maps.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Our problem with address data is the sheer size of the databases causing issues with processing in GIS and querying. We'd like a slimmed down version of AddressBase offered to tackle these performance issues.

Additionally, the file format of OS AddressBase is incredibly inconvenient and unpopular. The .gml file format can only be accessed using licensed (paid) ESRI software or PostGIS enabled QGIS plugins. For ease of access going forward, any addressing product needs to be supplied in ‘GIS ready’ File Geodatabases.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

We have existing partnerships with high tech satellite processing companies and have enjoyed that relationship. If the commission were to set up a repository of free to access ground deformation/observation datasets for the private sector, it could enable smaller companies to further innovation.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

-machine learning (automatic geo-referencing and digitisation of features on physical or digital maps.)
-Augmented reality (for viewing assets and hidden earth hazards from a first-person perspective)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

-public facing, interactive maps (?)

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

-commercialising and licensing out their datasets. Forming partnerships with the private sector.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

-making sure geospatial standards are met, requiring coordinate metadata to be included in every geospatial asset.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

-the private sector should liaise with public bodies, informing them of what geospatial datasets they find valuable. The funding from private is crucial to the maintenance and upgrading of government held data.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

-inaccuracy of coordinates. Specifically OS grid references being stored at 100m+ accuracy. Data points located at this level of accuracy are often useless to the end user (depending on use of course).

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

-by hosting a Government supported free-data repository. Utilising the reach and exposure of .gov.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Broadening upon the excellent work that the Environment Agency have done in opening their data, but they still hold more data of use. -

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

-allow public services access to a single, shared geospatial database and mapping platform. This would counter issues with overlapping data and missing information.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Regarding 'property and land', I again refer to the release/commercialisation/ capture of historical OS mapping. The UK has an extensive mining history which is often hidden on modern maps and in our landscapes. Revealing the hidden hazards would be immensely beneficial for lenders and purchasers in the property transaction process.
An Historic Land Use Database, or at least unlimited access to historic maps would become a successful asset.

Additionally OS MasterMap topo (vectorised) should be released as an affordable product, potentially subsidised by government. The access to MasterMap topo would allow more productivity and efficiency in smaller businesses/start-ups. Knowing the exact extent of a site and being able to directly use land parcel polygons cuts out the need for manual digitisation of boundaries.

Q17: Are there any other areas that we should look at as a priority?

-Satellite imagery capture and distribution. Specifically imagery that can identify vegetation change coverage (important for predicting landslides).

-The state of the UK's current addressing/parcels datasets is unnecessarily complicated. Currently there are 3 datasets, each sold/licensed separately through OS, Royal Mail and Land Registry: MasterMap Topo, AddressBase and National Polygon Dataset (NPD). The Commission needs to focus on amalgamating these datasets into a single offering. We want small businesses like Terrafirma to be able to access land parcel polygons with LR title numbers, addresses and UPRNs all included within each individual polygon feature.

Needing to purchase each entity separately and spend many man-hours combining the data is incredibly expensive and frustratingly time consuming.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

-

Q19: How best can we make the UK's presence in the international geospatial world more visible?

By showcasing free to use geospatial data on international data platforms such as ESRI's Living Atlas or similar.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

-State run licensing rounds for oil and gas exploration often involve the release of declassified seismic imagery. ie. PEMEX in Mexico's first licensing round.

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Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	The Crown Estate
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	X
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	X (Public Body)

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

We believe that the four types of geospatial data identified are accurate.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

We believe that an understanding of, and ability to deploy geospatial skills, needs to become inherent in non-GI roles for the UK to achieve maximum impact and value. For example geospatial data will play a key role within the Data Science domain (that we foresee as being key to industry over the next decade) but this is not a traditional GI role.

In our opinion the Chartered status offered by the AGI can be enhanced and made more prominent and recognised.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

We have a strong 'traditional' GIS function and will soon seek to expand using this as a core of a new data analytics and business intelligence function. We foresee a challenge in recruitment as we believe that when we go to market we will find Data Scientist or GIS candidates but very few who can blend the skills of both.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Improve access/availability of marine topographic datasets. Effectively provide marine base mapping as an equivalent to OS Basemapping on land. This would mean vector versions of the data held within UKHO admiralty charts, data which is currently only provided by commercial resale partners. OGA is already on a pathway to make this type of data in an oil & gas related context available. Making this data available would support a fuller and better understanding of the marine space, supporting smarter usage/conservation of the seabed by all parties. Also would help sharing of derived data between organisations.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

No comment at present

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Readily accessible and pre-processed Earth Observation data, either live or semi-live (e.g. time delayed) could provide benefits for monitoring difficult to access terrain, for example foreshore, for multiple uses e.g. to support health and safety concerns submitted by the general public

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

No comment

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

No comment

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

We believe that a 'freemium' model could be adopted to strike a balance between universal barrierless access to fundamental datasets and the need to maintain and develop these through the licencing of advanced attributes or additional geospatial fields.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

No comment.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Where appropriate it should be mandated that data collected by industry should be stored in the national DAC's or systems equivalent to The Crown Estates Marine Data Exchange so that once this information is no longer commercially sensitive it can be freely accessed by all interested parties. This will reduce the need to resurvey.

Whilst not 'private sector' we believe that crowd-sourcing should not be underestimated.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

No comment.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

We believe that a single source of access for geospatial data would be beneficial, and the Geospatial Commission could facilitate this.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit

from having access to, that might have novel and valuable use cases? What would that access look like?

We believe that the great benefit can be derived through the inclusion of OSNI data within the Geospatial Commissions remit.

Additionally, specifically in the marine space there is a lack of a publicly available dataset of submarine cables. The cables industry has been historically very reluctant to share the data which complicates offshore development. We believe the Geospatial Commission has a role to champion such datagaps within government and put in place plans to close these.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

No comment.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No comment.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**

- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Commenting specifically on the Property category, Internal Navigation, BIM and Building Management Systems hold great potential as they are either inherently geospatial, or can be enhanced by geospatial. All are emerging technologies/fields.

Q18: Are there any other areas that we should look at as a priority?

No comment.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comment.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Development of global leading projects and standards and seek to capitalise these by converting them into a marketable commodity that can be exported.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

No comment.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	The Royal Borough of Kingston upon Thames
Job title	[Text Redacted]
Address (work address)	[Text Redacted]
E-mail (personal e-mail address)	[Text Redacted]
Telephone (personal number)	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**X**
Large business (over 250 staff)	
Medium business (50 to 250)	
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Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I think it is accurate but needs to be expanded to cover funding. Without adequate funding in place, a lot of ideas or best practices just won't happen. Councils need to balance their books.

Innovation needs to include both private and public sector organisations and companies.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

It would be useful to have some focus on cartographic principles. This is useful when need to produce maps or display data online or on printed maps.

Database and programming knowledge is also extremely useful.

I think the British Cartographic Society should be included when it comes to cartographic side of it.

On the job training could be useful for some people.

My work involves dealing with mapping and addressing. This covers Local Land and Property Gazetteer; Local Street Gazetteer; Street Naming and Numbering and GIS. I also deal with spatial data exports and loads and run spatial queries.

There is no national course for Street Naming and Numbering, yet that discipline, determined an address of a new property. There are courses for LSG and LLPG, run by GeoPlace.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

My work involves dealing with mapping and addressing. This covers Local Land and Property Gazetteer; Local Street Gazetteer; Street Naming and Numbering and GIS. I also deal with spatial data exports and loads and run spatial queries.

I am in a Data Management Team which is tasked with the above, as part of a Shared IT and Digital Service for Kingston and Sutton.

However although we deal with the above, Sutton didn't want to remove the GIS responsibilities from their performance and insight team. The people in that team who remain, since one left to take a job with us, are not as experienced. We are currently providing one member of staff to help.

So there is a skills shortage in some parts of councils but in each council it will be different.

Kingston Council also has a Data and insights team, who have recently been rebranded. They deal with demographics. This is useful but the person who really understood GIS there left and hasn't been replaced. Newham Council recently showcased what they were doing through data mining to work out when and where to best target resources. I doubt people in the Data and Insights Team would have the skills to do that.

The skills may exist elsewhere in the council but it's matching the people up for the work required. It also needs to target management and make them understand why such potential change would be useful.

Highways is a shared service across Kingston and Sutton and they have a skills shortage when it comes to the data side of Highways. If you ask them if a road is adopted, they may not easily be able to find out. They should maintain a Highways register of officially named streets but we know this to be out of data.

When we have asked them to update the operational districts file, this has not always been done as they don't know how to do this. Similar for special events that need to be recorded in the LSG.

Then there is the special engineering difficulty. However if you ask them about road defects or Street name plates they could help.

Strategic planning had a GIS person but they were not replaced when they joined our team.

There was a heritage conservation office but their job wasn't renewed. Whilst it's not directly related to GeoSpatial data, it is useful when it comes to listed buildings and queries with them.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Trying to get hold of National Grid gas data is impossible. I did bump into someone, by chance, at a training course who might have been able to help but I never heard back from my email. I was too busy to chase them.

Whenever I contact the customer services I am directed to their high level electricity data set, even when I explain that isn't what I'm looking for.

Data on the location of broadband and telephone cables would be useful would be useful.

It would be useful if we could use the Green Openspaces for London dataset more widely, along with some of the information displayed in their Web mapping, which isn't available for download. However license restrictions apply. Also it was deemed not to have been used enough and the £2,000 better spent elsewhere so removed.

Access to the Postal Address File would be useful.

Historic Ordnance Survey maps, scanned by Landmark and sold under a license are only in black and white and are missing the marginalia. So one can't see

when the map was surveyed. It would be useful if more Higher resolution monochrome versions were available. The library of Scotland has done some work to make historical mapping available.

I am not certain if they charge for use but if that was widely available if could be useful.

It would be useful if there was a central repository for data or contacts for people who own data. For example if one wishes to get hold of Network Rail dsts in their railway lines, who does one contact?

Land Registry data is not easy to come by. They charge for tile. Some information is available under INSPIRE but it's from 2014 and doing a brief search on data.gov.uk, I couldn't find their data for Kingston.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Cleansing of address and street gazetteers will be important. Some of the issues encounter may require historical research as you can't go amending addresses without good reason.

Without access to good quality address data that wider ecosystem won't function as well.

Street data that is accurate and detailed will be increasing useful but it needs people with the right skills and mindset to update it and keep it updated.

Managers and senior staff need to understand the benefit or posts will be deleted or held open when people leave.

ooped examples and ideas of how one can use data to make improvements and efficiency savings.

When I left I felt I wasn't in a position to use any of it at work as we are still supporting legacy systems. Whilst these are being decommissioned, in their place is partly other systems that are from the dark ages.

The problem faced is that some companies come in during procurement exercises and charge so little for their product that they win on price alone. Then when you get them in you find the software isn't great and if you need to do certain things, they charge you a lot of money to do it for you.

You may say but you never told us we couldn't do this ourselves. They then respond but you never asked.

A nice more honest and modern company then doesn't get a look in because they were coming out at a higher cost. Of course with their software these things the other company charged for, can be done by yourself.

We need GeoSpatial staff in place to support the future. They need access to modern tools.

Back in about 2001, a then ground breaking system, Intergrated Spatial Information System [ISIS] was designed and released. In time however it stopped being ground breaking. Then it out lived its welcome.

However the users who used it for planning and Building Control, amongst others, liked it. So trying to convince others in other departments for the need too change is not easy.

One needs to get buy in from senior management.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

If we could be involved in Galileo but as we are leaving the EU it may not be possible.

Do we need to build and launch our own satellite?

Aerial photography data was made avilable to LGAs. However this data for Kingston the data is from 2013 and 2015, as well as possibly other years. So when a planning enforcement colleague had a query, the aerial photography couldn't be relied upon.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Drones and the data they could provide would be useful.

I can see the benefit but at work I'm tied up doing with supporting ISIS and I don't know if the people who might look at technology, would understand how this might be useful solution. Similar applies to data skills and how working with big data could bring about change but people with the right skills might not exist in an organisation or they exist but are not involved.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

GeoSpatial data can be used to roll out high speed broadband. It could also be used to locate mobile blackspots. Currently there are areas where mobile companies claim their to be a good coverage outside but actually there is not. This is evident in Surbiton when connecting to O2 mobile phone data.

The other week I attended a Data4good conference in London. Lots of hooped examples and ideas of how one can use data to make improvements and efficiency savings.

When I left I felt I wasn't in a position to use any of it at work as we are still supporting legacy systems. Whilst these are being decommissioned, in their place is partly other systems that are from the dark ages.

The problem faced is that some companies come in during procurement exercises and charge so little for their product that they win on price alone. Then when you get them in you find the software isn't great and if you need to do certain things, they charge you a lot of money to do it for you.

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However the users who used it for planning and Building Control, amongst others, liked it. So trying to convince others in other departments for the need to change is not easy.

One needs to get buy in from senior management

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The use of drones and data mining could help public sector organisation's modernise what they do. However this requires modern software and skills.

Currently some councils are supporting legacy systems or getting in computer systems built in the dark ages. These may not be good but they are cheap.

This hinders innovation and isn't the best use of funds. However because they are cheap councils feel they have no choice but to award them as the contact. Sometimes exemption reports can then be written but this is only after months of issues.

We are currently undertaking address matching with the council Revenues and Benefits system and Electoral Register.

If we find properties in the Revenues and Benefits system that are on the wrong street, they have to amnauuky move across each case. This is time consuming and could lead to errors.

They recently looked into procuring a new system. However it was deemed the competition wasn't much better so they rewarded the contact to the same company.

So if something could be done to widen the private sector companies building software for the public sector, this will free up Officer time to do so much else.

To continue to enhance the Geospatial datasets we need people who understand their value and what can be done with them. We need to invest in staff who can then invest in the data if you don't invest in staff they will go to the private sector.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We need to improve the mobile data connectivity. O2 for example claim good coverage outdoors on O2, yet in parts of the town it's non existent despite claims it is good.

So their needs to be more data monitoring of the data provided by large organisations about themselves and their service.

We need 5G to come on stream. Galileo satellite would be useful but the EU may prefer us to not be involved as we are leaving the EU. How much would it cost to

build our own?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector could help fund innovation, for example through software innovation, if done fairly. However, having companies like iDox, who use very old system architectures and charge little for the product, don't help as they keep winning work, despite the software not being modern or as good as some rivals.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The challenges faced relate to organisational structures and remits. Better value could be released if we could work with the best outcomes.

For example SOCTIM provided funding for digital work via a private company. As a result work was found for them to do, to justify the money being given. However the company wasn't an expert in the area being worked upon. A better solution existed which may even have been cheaper but because this funding needed to be used for something it was kind of shoehorned in.

GeoSpatial data needs to be accessible across multiple systems. This isn't always possible. For example an ArcGIS platform can't read MapInfo TAB files. There are software packages that will do the translations but those cost.

Politics also plays a part. So someone may want to do something their way because it gives other people something to do. So they reinvent the wheel when it is not needed.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It needs to promote what the public sector can offer.

Could the public sector make money by offering their services to the private sector? Thinking commercially would be a different mind set.

It needs to promote the kind of jobs that the public sector could offer. This would be to applicants and senior council staff.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Royal Mail Postal Address File including Multiple Occupancy File and Not Yet Built File.

Please also see answer to question 4, as it is relevant here.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

We need a direction of travel plan setting out how we want the future to be. From this different industry bodies might be able to take strands and further develop those.

There would need to be oversight of this to ensure the standard was high and consistent.

I like the INSPIRE directive, it needs to be something understandable.

At work we now talk about plans of action rather than strategy. Could there be plans of action from the Geospatial Commission.

Could more agile methods of working be allowed to spatial data work.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

We need a local government body tasked with ensuring effective of geospatial data. This however needs to encompass not just technical people but also a managers and directors, as well as councilors so that local buy in to this can be seen.

I have been to conferences, such as Data4good and can see uses for what was being showcased and discussed. However I don't have the time and nor am I in a position to make use of any of it. Technically it was a waste of time me going for work, although on a personal interest level it was good. There are other people for whom it might have been useful to attend and in future I shall encourage it.

We also need to find a way of stopping companies bidding cheap to win work when their systems are poorly designed or they charge of extras you need but aren't aware of. This doesn't help people make best use of location data.

It's not fair on those modernising and being honest in their bidding process tenor.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Not certain.

Q18: Are there any other areas that we should look at as a priority?

The funding of all of this needs to be looked at. If it's not funded properly and more data is made available for free, the quality will drop.

Where I work they are funding two additional posts but these are only for 18 months. We may struggle to get people in as who wants an 18 month post when it isn't a contract but a permanent member of staff. I thought about applying for a senior role but the chances of being seconded are allowed as I have knowledge of obsolete systems we wish to try and get rid of but until they go need to be supported.

It needs to look at whether broadband and phone services should be considered essential infrastructure that can offer utility companies the ability to dig up roads under emergency powers.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

High speed broadband; location of Internet connected street furniture; property; land and street data. The challenges in this are if the Data existing is of poor quality or simply of mix quality.

Until it is cleansed one may not have the correct answer.

In the past some Street Naming and Numbering hasn't always been up to the same guidelines we use now. In some cases there is a need to investigate whst was done in the past as the naming and numbering of properties and streets is a legal process. Doing research on this can be slow and time consuming. However if we want modern reliable address data, it needs to be completed.

Other challenges might be political. So someone might want to do something one way because that is what they know and have skills in. If they could be reskilled to where it's needed it may help. However it costs.

Q20: How best can we make the UK’s presence in the international geospatial world more visible?

We need to make the data available of internally recognisable platforms. We need to attend conferences and markets aimed at GeoSpatial Data.

We need to sell our skills. The Ordnance Survey provide consultation support to other countries and have in the past even mapped some of these countries. We need to build upon this without organisations.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

I don't know much about the foreign market but it might be interesting to see what the French and Swizz are doing as certainly they do produce good national series of maps

Thank you for your time in completing your response to our call for evidence.

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geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	The Survey Association (TSA)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
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Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
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Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Geospatial data types listed cover a broad spectrum, but the descriptions are very weighted towards traditional GIS and don't cover, by that definition, the type of large scale, detailed surveying (Land, Utility and Hydrographic data capture) that form the corner stones and foundations of any quality data set. Use of the word 'place' instead of 'position' reinforces this GIS language.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Focus has been shifted away from traditional land surveying techniques to data capture utilising black box technology. As this technology further develops, surveyors of the future will be data managers but with little in the way of theoretical knowledge to quality assure the valuable data collected. The commission should ensure land and hydrographic surveying is supported and promoted as a professional service offering and it is critical that government agencies interface with SMEs, many of whom are represented by TSA, to develop mutual understanding and support and to recognise and trust the quality of SME data collection and presentation.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

There is a significant skills shortage at Geospatial sciences grass roots level and whilst the recently approved Geospatial Sciences and Mapping Apprenticeship will go some way to plugging the gap, it needs considerable focus from the commission to support this and promote at secondary school level land/utility/hydrographic surveying as a career choice. This should be through incorporating the work of a 'Class of Your Own' and their Design Engineer Construct curriculum into schools creating the link to those teaching the level 3/6 apprenticeships and higher education. The course currently run at TSA's Survey School provides an opportunity for formal training and qualifications in land survey where experienced technical surveyors can enhance their theoretical and practical knowledge. This is a skills gap often overlooked and one that greatly enhances the quality of data capture and delivery across a wide range of industry sectors.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Data collected, licensed by TSA members, is of a significant value and TSA would welcome further discussion with the Geospatial Commission on how we can work in partnership to unlock the potential of these datasets for the benefit of all. This has particular merit in the utility mapping sector, where utility providers' geospatial datasets are often historic and originate from sources of varying quality. Access to foundation datasets, such as LiDAR, DEM and aerial photography, is still constrained.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

NA

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The commission should look to work with TSA and in discussion with their membership to ensure developments in this area benefit both public and private sectors. By harvesting the combined knowledge of TSA membership, the impact of these developing and emerging technologies to market can be optimised.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The land, utility and hydrographic survey industries rely on evolving and new technologies to stay at the forefront of efficient data collection and processing, ultimately adding value to stakeholders and clients. What the commission does need to look at is how these new technologies are regulated within industry, managed and operated by suitably qualified professionals. Currently there are too many early adopter 'hobbyists' who have little or no geospatial sciences qualifications utilising these new technologies (such as drones) to compete against reputable survey companies.

One key bottleneck is the telecoms / internet data transfer speed available for users transmitting increasingly large geospatial datasets.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The commission should look to work with TSA and, in discussion with their membership, to ensure the vast experience the membership can bring in this area will benefit both public and private sectors. Land, Utility and Hydrographic professionals are early adopters of technology and develop workflows at the front end of the technology lifecycle to ensure efficiencies are captured through developing 'lean' geospatial data capture and processing applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public Sector organisations should look to work with professional Land, Utility and Hydrographic Survey companies to ensure the quality and integrity of their geospatial datasets are maintained. Often public-sector organisations procure survey data as a commodity service rather than a professional one, using the 'cheap is best' mantra. Many of these organisations do not have embedded survey professionals on the procurement team so tenders are evaluated based on minimal technical input. Or they are evaluated using standard procurement matrices which value cost over technical compliance. This puts the integrity of the commissioned datasets at risk.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The importance of OSNet is now critical to most geospatial data collection, and devices that provide OSTN15 / OSGM15 coordinates are in universal use in the professional surveying and construction environment. Maintenance and enhancement of this network, with support for partner network correction service providers, is essential for the future. The use of this universally accessible coordinate system is vital to BIM applications on many construction projects.

See also answer to question 8.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

This is an extension to the answer given in question 9. The commission should look to collaborate with TSA and in discussion with their membership to ensure development and maintenance in this area benefits both public and private sectors. By harvesting the combined knowledge of TSA membership, the vast collective experience in this area can be exploited. The private sector has a uniquely varied experience of geospatial data collection and this experience is an underused resource at high level in the Public sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Again, this is an extension to question 9 and the commission should work with TSA to look at how procurement of geospatial data can be managed to add real value to the public sector. The mantra of 'survey once; use many times' is often quoted but seldom adopted in the public sector, costing tax payer's money and is unregulated. TSA are constantly looking to drive up standards and the Geospatial commission can support by looking at how the public sector procures geospatial data and the selection criteria used for evaluating tenders.

An example of this is the support (both commercial and technical) to the development of PAS128 Specification for underground utility detection, verification and location. Currently TSA are working on a pilot with Lloyds Register to create an accreditation to PAS128, which survey companies can use as evidence of competency in this area of Geospatial data capture, processing and management. Without support of both public and private sector clients to recognise this as a standard of competence in this area, this becomes just another badge and companies will 'buy cheap', undermining what PAS128 as a British Standard was developed for**.**

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Previous answers in Questions 9-12 cover this.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

TSA membership work for many public-sector clients and the commission should look to work with TSA and in discussion with their membership to ensure the vast experience the membership can bring in this area will benefit the public sector. TSA look to ensure the geospatial datasets captured for public sector clients adopt the mantra of 'survey once; use many times', but at a local level, surveys are commissioned of the same geographical area, often to similar specifications by different departments within the same public-sector organisation. This not only costs the tax payer money but creates quality conflict through uneducated specification commission and devalues the dataset for future use. We believe that this collaboration would have value in regard to utility mapping data, where our data can have a significant positive impact on health and safety during excavation.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Treat procurement of geospatial datasets as a professional service offering and not a commodity service, where qualified professional surveyors manage the procurement process and sit on tender evaluation teams. Build a cross local authority Geospatial Management team of these individuals to share through a community of practice, lessons learned, and this will enhance the quality of future datasets for a variety of uses to improve public sector services. Local authority funding and budgets need to allow data sharing. Their hands are often tied as money is awarded for a specific project which delivers to a bespoke in-house system. A more generic/releasable dataset is usually more expensive as, for example, it requires effort to determine IPR release or more resource to deliver data in a format that suits both the LA's dataset and more open source ones. This is then outside of the funding remit so not undertaken.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Applications that offer considerable value but are often not linked to long term economic value include flood mapping for hydraulic modelling, Utilities Survey to PAS128, Survey4BIM, terrestrial laser scanning and mobile mapping, deformation monitoring, measured building surveys, high precision GNSS control, topographical mapping and implementation of Virtual Reality and Augmented Reality.

Q17: Are there any other areas that we should look at as a priority?

- Delivery of PAS128 surveys by accredited organisations/companies
- Support Survey4BIM's BIG5 Geospatial Challenges
- UK Cadastral System

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

N/A

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Promotion and support by the Geospatial Commission at industry conferences such as the annual GeoBusiness conference and TSA conferences, will raise the profile of the private sector survey profession and therefore offer a networking gateway to the global reach of the companies that operate within it.

Work with Industry bodies who already have these relations to offer support and utilise relevant adjacencies to build on existing relationships. For example, TSA recently hosted a Chinese delegation (lead by He'nan Administration of surveying.mapping and Geo-information) at the HQ of the RICS.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The approach to geospatial procurement and management of valuable datasets by the He'nan Administration of surveying.mapping and Geo-information should be explored further.

The commission should look to work with TSA and in discussion with their membership to ensure the vast experience in international expertise the membership can bring in this area is captured.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	The Wildlife Trusts
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The Wildlife Trusts welcome the opportunity to comment on the Geospatial Commission's Call for Evidence. The Wildlife Trusts are considerable collators, holders and uses of geospatial data. Much of our work is driven by a spatial understanding of the natural environment.

There is a Wildlife Trust caring for wildlife and wild places near you. We have a shared mission to create an environment rich in wildlife for everyone. We know that a healthy natural environment is the source of our prosperity and our wellbeing. We want to inspire people about the natural world so that they value it, understand their relationship with it and take action to protect and restore it. We are actively engaged in the planning system, promoting opportunities to improve the natural environment and reviewing more than 60,000 planning applications a year. We have more than 800,000 members including 150,000 members of our junior branch Wildlife Watch. Every year we work with thousands of schools and our nature reserves and visitor centres receive millions of visitors. Each Wildlife Trust is working within its local communities to inspire people about the future of their area: their own Living Landscapes and Living Seas.

The Call for Evidence consultation document states that *"The overarching objectives of the Commission are to increase economic growth and improve social and environmental outcomes"*. However, the document fails to recognise the importance of environmental spatial data to business and to the public sector, and ultimately, the economy. **The Wildlife Trusts believe that greater emphasis should be given to the importance of geospatial data for the environment**, not just for environmental decision making but for the sustainable development, economic and social benefits from having good geospatial data on the environment.

Nature Recovery Network
In the Government's 25 Year Environment Plan[1], they committed to "develop a **Nature Recovery Network** providing 500,000 hectares of additional wildlife habitat, more effectively linking existed protected sites and landscapes, as well as urban green and blue infrastructure" and that "we will develop maps and advice to show where actions to improve and restore habitats would be most effective".

A Nature Recovery Network is a **joined-up natural system of places important for wild plants and animals, on land and at sea**. This network of interconnected wildlife-rich places allows ecological processes to function. It includes all the places where these processes contribute to flood-risk management, carbon storage, improved air quality, water purification, outdoor recreation, community cohesion, cultural inspiration, education, health and wellbeing. It brings value to people.

This **spatial plan for the environment** would ensure public spending and investments result in well informed decision making that is better targeted, more effective and delivers multiple benefits. It would also enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate development sites. It would **enable more efficient targeting of public, private and charitable funding in the urban and rural environment to contribute to nature's recovery**. The existence of such maps would bring benefits in the improved targeting of advice and other effort related to a number of central government strategies (such as the National Pollinator Strategy). It could contribute to cost reduction in various public-sector areas, for example by aligning green infrastructure provision with those areas suffering from health inequalities, and by informing rural and farming subsidies to secure the most effective delivery of public goods. By combining environmental and social data this mapping will benefit businesses, the public sector and the environment sector, helping to plan and locate activities and projects in a way that will deliver better outcomes and give the highest return on investment, whilst having a net positive impact on the environment.

The process of **targeting and distributing agricultural payments** to generate publicly beneficial environmental goods and services would be enhanced considerably if it was contributing to a coherent spatial plan for nature's recovery.

The role of Nature Recovery Maps in providing specific spatial focus would enable more **effective and efficient investment of "environmental net gain" funding from developers**. In addition, the National Infrastructure Commission is tasked with identifying strategic infrastructure needs that would enable significant opportunities for economic development. As illustrated by the current proposals for the Oxford to Cambridge Expressway and associated development, their work does not include a strategic consideration of the environment, so it inevitably prioritises hard infrastructure and other built development over protection of the natural environment at an early stage in the process, and overlooks opportunities for strategic development planning to contribute actively to nature's recovery (when this would bring significant social and economic benefits).

[1] HM Government (2018) *A Green Future: our 25 Year Plan to Improve the Environment*.

It would also **enable investment into natural capital** intended to enhance the provision of ecosystem services to generate cost savings, commercial income and/or investment returns. The Natural Capital Committee has demonstrated that the social and economic value of a healthy, ecologically functioning network or places that are rich in wildlife would be extremely high. Many businesses rely on natural capital and, despite the emergence of natural capital accounting, the value of these resources to a business are not currently truly recognised or appreciated. For example, the manufacturing and food sectors rely on having a regular and plentiful supply of clean water (e.g. breweries, car manufacturers). In March 2018, both Jaguar Land Rover in Solihull and the Cadbury's Factory at Bourneville had to cease production when their water supply was interrupted (due to burst water mains following the cold weather).

Developing Nature Recovery Maps is key to supporting both the recovery of wildlife and the **improvement of public health**, by increasing regular access to nature for all. Currently, those living in the most deprived areas are ten times less likely to live in the greenest areas. Lack of access to nature is a significant factor in health inequality, leading to increased mental and physical health risks. Natural England has estimated that if every household in England were provided with good access to quality green space (enabled in future by creation of a Nature Recovery Network), it could save an estimated £2.1 billion in healthcare costs[2].

The Wildlife Trusts believe that local authorities should be required, with full support and funding from central government, to develop **Local Nature Recovery Maps** to achieve these objectives, and to embed them in local plans. These maps and plans would then guide decisions on housing and development to ensure they make a positive contribution to nature's recovery. They would also inform strategic decisions on the targeting of public funding for farming and land management, to maximise the positive impact on wildlife. And they would guide other forms of regulation and investment to maximise their effective contribution to nature's recovery.

The Conservative Party Manifesto 2017 committed to creating a geospatial data body within government but it also committed to ensure this new body "set the standards to digitise the planning process and help create the most comprehensive digital map of Britain to date"[3]. Any national map **must** include environmental geospatial data.

Environment Bill

The Wildlife Trusts are also part of the Greener UK Coalition. We are calling for an ambitious Environment Bill intended to ensure the recovery of nature for the benefit of wildlife and our own health, wellbeing and prosperity. We believe a Westminster Environment Bill must:

1. Set ambitious and measurable goals for nature's recovery and a healthy environment including new legally binding targets
2. Deliver improved access to nature and map a network that makes space for wildlife

[2] Natural England (2009). Technical Information Note 055 – 'An estimate of the economic and health value and cost effectiveness of the expanded WHI scheme 2009'

[3] The Conservative and Unionist Party Manifesto (2017) *Forward, Together. Our plan for a Stronger Britain and Prosperous Future.*

3. Enshrine strong environmental principles and create an effective independent watchdog.

Having access to up-to-date, comprehensive geospatial data is **essential** for all three of those components.

Greener UK has also identified a set of thematic and time-bound objectives that should address at least the following:

- **A healthy environment**
  - *a. Air quality is safe for human health and the environment;*
  - *b. Our freshwaters and seas achieve good ecological status and good environmental status respectively, able to support a wide diversity of wildlife;*
  - *c. Soils have been returned to a healthy status and any uses are sustainable;*
  - *d. The extent, quality and connectivity of habitats is increased and natural processes restored, so that ecosystems on land and at sea are resilient; and natural beauty and heritage enhanced in our landscapes;*
  - *e. The richness of species is maintained and their abundance maintained at, or restored to, at least favourable conservation status on land, in freshwater and at sea, with human-caused extinctions prevented;*

- **People engaged and empowered**
  - *f. Everyone has access to high quality natural greenspace where they live, to contribute to their wellbeing, mental and physical health;*
  - *g. Environmental justice is delivered for all, including the poorest in society and future generations;*
  - h. *Everyone receives an inspiring environmental education and environmental matters are properly communicated to and understood by the public;*

- **Our impacts managed**
  - *i. Climate change drivers are addressed and the environment is managed to deliver our long-term climate change adaptation and mitigation goals, for example habitat connectivity and carbon storage in soils, deep peat and forests;*
  - *j. New invasive species, pests and diseases are not being introduced to or becoming established in the UK, and those already here are at least under effective control with their harmful impacts addressed;*
  - *k. Where natural or manufactured resources are used, this is done sustainably and equitably, and our waste has no negative impact on the environment;*
  - *l. The UK economy is operating within its fair share of global environmental limits, with the UK's overall impact on the global environment being net positive; and*
  - *m. Chemicals are manufactured, transported, stored, used and disposed of safely to protect people's health and the environment.*

Again, measuring progress towards these objectives will all require geospatial datasets some of which may currently exist but others may need to be developed.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In recent years, the use of GIS has become integral to the ability of many Wildlife Trusts to deliver a wide range of core work. It is a powerful mapping tool but also a way to analyse complex data to aid planning, analysis, reporting and inform decision-making. As a result, there is a need for everyone to have a basic understanding of what GIS can do and how to interrogate the information. We believe that understanding spatial information should be a basic skill available to everyone in ecology and environmental activities, just as using word processing or spreadsheets.

There is also a need for more proficient GIS users and at least one highly proficient user in each Wildlife Trust. However, based on TWT experience, we are likely to benefit more from ecologists with GIS skills rather than GIS graduates with no ecological knowledge.

Many Wildlife Trusts are in the fortunate position to have an individual member(s) of staff responsible for GIS across, and therefore have internal support. Generally, The Wildlife Trusts find that often new graduates have GIS skills but it is staff members and decision-makers over the age of 35 that have had limited exposure to GIS – either training or in practice. The work of the Geospatial Commission could play a positive role in ensuing a culture change around the use of geospatial data in decision making.

The cost of software can actually be the barrier to individual Wildlife Trusts. The GIS software used by the various Wildlife Trusts differs across the country. Some have chosen to invest considerable resources into licenses for ArcView software. They have chosen ArcView over free GIS software (such as QGIS) or cheaper programmes (such as MapInfo) because of the increased functionality it provides in terms of being able to run GIS queries. ESRI still offers value for money but only for a limited number of users because of licensing costs and the expertise required.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

There is now a considerable number of geospatial datasets that are open access. However, the creation of a single, easier to use, Open Data Portal making it easier to find the available data and identify the most current versions would be extremely beneficial. For example, there are approximately 1,500 Environment Agency datasets on the data.gov.uk website so promotion or that and/or knowing how to find datasets would be useful.

There is also a considerable amount of data on the data.gov.uk website that is described but not actually released meaning we know the data exists but we do not have access to them. For example, **abstraction data**. There is a record on data.gov.uk for Abstracted

Surface Water Abstractions and for Abstracted Groundwater Water Abstractions, but neither datasets are released.

There is a real need for a nationally agreed standard habitat and land-use map. Without a good evidence base, we will always be vulnerable to making poor and incorrect decisions (see answer to question 12). In addition, greater consideration needs to be given to standard approaches to datasets collected and represented by county and local authorities so that these can be combined, used and interpreted across administrative boundaries.

There are also a number of areas where The Wildlife Trusts believe the Geospatial Commission should prioritise to target. These include:

- **Environmental data.** Providing easy access to spatial data that shows where our best areas for wildlife are could help speed-up the planning process. This needs to include information on legal obligations. Currently, there are big gaps in terms of quality and quantity of data available at local and national scales with the most detailed and accurate data held at a local level (for example, the NRN Atlas has many species records but it is low resolution national data on protected species compared to the high resolution, more geospatially accurate data held by Local Environmental Records Centres). Access to these more detailed and useful datasets could be improved by making funding available to support the organisations involved in collecting the data (in the same way that the Ordnance Survey requires security of funding for it to carry out its detailed mapping work).
- **Geological data.** Having access to good quality, open source geological data would be useful as an input into Nature Recovery Network, habitat creation and restoration opportunity, ecosystem services and natural capital mapping.
- **Public Rights of Way data**. This is held by local authorities and not always freely shared. However, to analyse the accessibility and recreational value of green spaces, this data is essential.
- **Aerial Mapping.** The Wildlife Trusts would welcome greater access to up-to-date aerial mapping as it is expensive and, quite often, long out of date. It is possible to use the aerial photo feature on Google, which are often better and a good source of information, but these cannot be interrogated in the same way in GIS.
- **OS MasterMap.** The Wildlife Trusts would really welcome full access to OS MasterMap as a desired end point. It would make much of our work, especially that with landowners and in the wider countryside, more efficient and accurate. At the moment, public sector organisations benefit from a Public Sector Mapping Agreements (PSMA) to access and share Ordnance Survey digital mapping. However, this PSMA does not extend to charities. Vector OS data is developing well but it would be useful if further features could be fully mapped.
- In terms of **artificial intelligence** data, the ability to map the movement of water (e.g. through channels in a reedbed) would be very helpful.
- Ensure that **shared European Union data** remains available in the UK after Brexit (e.g. the European Soil Database from the European Commission's Joint Research Centre).
- **Pollution Incident** data would be useful in targeting restoration projects and advice. There is some information on data.gov.uk but it is mostly older and limited in the amount of detail it contains. We appreciate that this might be due to

privacy issues relating to personal information but even knowing the type of incident (e.g. agricultural, domestic, industrial) would be beneficial.

If Government were to increase and improve access to the above Geospatial Data, the Wildlife Trusts would prefer to see this to develop as **Local Nature Recovery Maps** and to embed them in local plans. These accessible maps and plans would then guide decisions on housing and development to ensure they make a positive contribution to nature's recovery. They would also inform strategic decisions on the targeting of public funding for farming and land management, to maximise the positive impact on wildlife. And they would guide other forms of regulation and investment to maximise their effective contribution to nature's recovery.

In addition, this would also enable the current Government to achieve their commitment to ensure this new body "set the standards to digitise the planning process and help create the most comprehensive digital map of Britain to date"[1].

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The Joint Nature Conservation Committee (JNCC) has been working on some Intermediate Product Satellite Data which takes the complexity out of satellite image processing, allowing a wider audience to access and use derived information. Intermediate Products derived from the European Space Agency Copernicus data sets (optical, radar and atmospheric-sounding satellite systems) will allow a robust long-term series of Intermediate Products to be created. However, this work now appears to have been paused or delayed.

[1] The Conservative and Unionist Party Manifesto (2017) *Forward, Together. Our plan for a Stronger Britain and Prosperous Future.*

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

A **spatial plan for the environment** would ensure public spending and investments result in well informed decision making that is better targeted, more effective and delivers multiple benefits. It would also enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate development sites. It would **enable more efficient targeting of public, private and charitable funding in the urban and rural environment to contribute to nature's recovery**.

The Wildlife Trusts believe that local authorities should be required, with full support and funding from central government, to develop **Local Nature Recovery Maps** to achieve these objectives, and to embed them in local plans. Taking this innovative approach, these maps and plans would then guide decisions on housing and development to ensure they make a positive contribution to nature's recovery. They would also inform strategic decisions on the targeting of public funding for farming and land management, to maximise the positive impact on wildlife. And they would guide other forms of regulation and investment to maximise their effective contribution to nature's recovery. This approach would require the best available data and is dependent on mapping licenses and data from a variety of sources:

- identify and highlight the precise location and extent of our "core natural assets" (Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves, Local Wildlife Sites, non-statutory nature reserves, etc. Marine Protected Areas, at sea);
- plot the known location and extent of priority wildlife habitats (including semi-natural ancient woodland);
- calculate the ecological connectivity between the existing components of the "core natural asset" network, and between networks of known priority habitat;
- combine this essentially wildlife/biodiversity information with other available social and environmental data that can be presented spatially (soil type, geology, hydrology/flood-risk, air quality, health statistics, etc);
- identify the location and extent of "restoration sites" where pro-active interventions to repair damaged and degraded habitats would enhance the ecological value, function and connectivity of the "core natural assets", and where this would be technically possible and politically desirable;
- plot out the boundaries of a wider "recovery zone" within which there is the greatest opportunity and need for poor quality existing habitats to be restored, for the existing "core natural assets" to be extended, buffered and linked, and for new wildlife-rich green and blue spaces to contribute to the wellbeing and prosperity of people;
- calculate and demonstrate the social and economic value of measures to protect, enhance, restore and create habitats in different parts of the Network.

However, as a consequence of public sector cuts, The Wildlife Trusts are aware of the impact these have had on local authorities as they have lost both ecologists and individuals with the skills and expertise to use and interpret both ecological and GIS data. Given how

much they depend on geospatial data, this is a considerable concern and should be addressed.

The public sector need access to up-to-date, locally informed data on which to base decision making. They should have a role in supporting this through either direct funding and/or through two-way data sharing agreements. There needs to be an increase in investment from public sector organisations to secure and maintain up-to-date local data and to support the integration of local datasets into national datasets. Many Wildlife Trusts have a good record in providing ecological geospatial data to local authorities, often through partnerships to share the costs of maintaining ecological data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector has a crucial role in both the development and maintenance of enhancing the UK's geospatial data assets.

The private sector does need to pay for geospatial data that has a commercial benefit and that has been collected using taxpayers' money or charitable resources. For example, Local Environmental Records Centre (LERCs) hold vast datasets on species and habitats across the country. Currently, most of them do not charge for data but instead charge for the time it takes to collate the data and format reports. Ultimately, it costs LERCs to collect, manage and provide data. The costs need to be borne by partners or recovered (either commercially, through public sector funding etc). Currently, commercial enquiries provide good income for most LERCs. This helps fund staff time to collate and update data for protected species through liaison with recorders, field world and data extraction.

In addition, any geospatial data gathered by private companies should be shared a certain time after its commercial use. Businesses and developers should also contribute to high quality datasets so that more information is available ahead of the planning application process. This would reduce the need for surveys and potentially speed up the decision-making process. For example, Natural England is currently developing a District Strategic Licensing approach for Great Crested Newts (GCN). This approach would assess the degree of risk posted by development to GCN populations. This baseline risk, in light of current GCN distribution modelling, would be mapped and developers would pay a tariff that would vary depending on whether the proposed development was in a very high, high, medium or low risk area. Developers and businesses should be helping to resource the high quality datasets required.

We also believe that data collected by statutory agencies should be shared with non-profit companies and charities, preferably through Local Environmental Records Centres. Again, this doesn't happen routinely and it can be a challenge to access data from Natural England.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The Wildlife Trusts do face issues trying to use Ordnance Survey data and licenses. OS say that data digitised to one of their base maps can only be given to those with the same base map licence. It they could change the rule so that the organisation producing the layer needed to pay for the licence and those just displaying it didn't, that would make data considerably more shareable. At the moment, public sector organisations benefit from a Public Sector Mapping Agreements (PSMA) to access and share Ordnance Survey digital mapping. However, this PSMA does not extend to charities. The Wildlife Trusts would really welcome full access to OS MasterMap as a desired end point.

The Wildlife Trusts are able to access some public-sector data (e.g. layers from Highways England about routes of new roads). In addition, some Wildlife Trusts have entered into data sharing agreements with Local Environmental Records Centres to get habitat mapping, species records etc. But, this approach is not uniform across the country and the quality and availability of data, especially habitat mapping, varies greatly. For example, some parts of the country do not have Phase 1 habitat mapping. Just providing that to the same standard nationally would be extremely beneficial.

As part of their Habitat Network Mapping Project, Natural England has produced a series of maps. They are still under development, but we are aware that some are beginning to be used. However, we have concerns about the maps and the underlying datasets being used. Natural England has, so far, just used their national Priority Habitat Inventory (PHI) datasets. However, for some habitats and locations, this data is wrong. For example, the Hertfordshire and Middlesex Wildlife Trust has compared the NE Priority Habitat Inventory (PHI) to the Hertfordshire Environmental Records Centre (HERC) data. For Lowland Heathland, the NE PHI identifies a considerably larger area of lowland heathland than HERC habitat mapping for a number of reasons including:

- At Croxley Moor Common SSSI, the NE Priority Habitat has the area incorrectly attributed to heathland when it is acid grassland. Even the NE SSSI condition report (Jun 2014) records the site to be acid grassland but the Priority Habitat Inventory has not been corrected.
- At Rail Copse, most of entire site is included on the ancient woodland inventory (and aerial photography shows it does not contain clearings) yet it is included on the NE Priority Habitat as lowland heathland.

Natural England has acknowledged that local data needs to be included to make them more relevant to a local area. But, the public sector has to provide resources if it wants data ground-truthing and monitored. NGOs cannot and should not be expected to do this for Government for no cost.

Some local authorities do not have access to Local Wildlife Site data or information on protected sites data. However, this is required to perform their statutory duty under the Natural Environmental and Rural Communities Act (2006). However, the biodiversity duty has been described by a House of Lords Select Committee as "ineffective as it stands, as a result of limited awareness and understanding among public bodies, weak working

and the lack of clear reporting requirements and enforcement measures"[4]. As a result, Local Authorities (and public bodies) consider the lack of this data as low risk and choose not to fund its provision.

These challenges need to be addressed and resolved if Government is to meet its commitment in the 25 Year Environment Plan[5], to "develop a Nature Recovery Network providing 500,000 hectares of additional wildlife habitat, more effectively linking existed protected sites and landscapes, as well as urban green and blue infrastructure.". A Nature Recovery Network is a **joined-up natural system of places important for wild plants and animals, on land and at sea**. This network of interconnected wildlife-rich places allows ecological processes to function. It includes all the places where these processes contribute to flood-risk management, carbon storage, improved air quality, water purification, outdoor recreation, community cohesion, cultural inspiration, education, health and wellbeing. It brings value to people.

This **spatial plan for the environment** would ensure public spending and investments result in well informed decision making that is better targeted, more effective and delivers multiple benefits. It would also enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate development sites. It would **enable more efficient targeting of public, private and charitable funding in the urban and rural environment to contribute to nature's recovery.** But, it relies on having access to up-to-date, comprehensive environmental geospatial datasets.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The creation of a single, easier to use, Open Data Portal making it easier to find the available data and identify the most current versions would be beneficial. For example, there are approximately 1,500 Environment Agency datasets on the data.gov.uk website.

There is also a considerable amount of data on the data.gov.uk website that is described but not actually released meaning we know they exist but do not have access to them. For example, abstraction data. There is a record on data.gov.uk for Abstracted Surface Water Abstractions and for Abstracted Groundwater Water Abstractions, but neither datasets are released.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

[4] House of Lords (2018) *The Countryside at a crossroads: Is the Natural Environment and Rural Communities Act 2006 still fit for purpose?*
[5] HM Government (2018) *A Green Future: our 25 Year Plan to Improve the Environment*.

The Wildlife Trusts believe that local authorities should be required, with full support and funding from central government, to develop **Local Nature Recovery Maps** to achieve these objectives, and to embed them in local plans. Taking this innovative approach, these maps and plans would then guide decisions on housing and development to ensure they make a positive contribution to nature's recovery. They would also inform strategic decisions on the targeting of public funding for farming and land management, to maximise the positive impact on wildlife. And they would guide other forms of regulation and investment to maximise their effective contribution to nature's recovery. It would also **enable investment into natural capital** intended to enhance the provision of ecosystem services to generate cost savings, commercial income and/or investment returns.

To support this, public bodies would also benefit from there being a Nature Recovery Network map as, amongst other things, it would highlight where lack of access to nature is exacerbating health deprivation, where environmental features are delivering ecosystem services, where resources targeted to deliver parts of the NRN would deliver many public benefits.

This approach would require the best available data and is dependent on mapping licenses and data from a variety of sources:

- identify and highlight the precise location and extent of our "core natural assets" (Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves, Local Wildlife Sites, non-statutory nature reserves, etc. Marine Protected Areas, at sea);
- plot the known location and extent of priority wildlife habitats (including semi-natural ancient woodland);
- calculate the ecological connectivity between the existing components of the "core natural asset" network, and between networks of known priority habitat;
- combine this essentially wildlife/biodiversity information with other available social and environmental data that can be presented spatially (soil type, geology, hydrology/flood-risk, air quality, health statistics, etc);
- identify the location and extent of "restoration sites" where pro-active interventions to repair damaged and degraded habitats would enhance the ecological value, function and connectivity of the "core natural assets", and where this would be technically possible and politically desirable;
- plot out the boundaries of a wider "recovery zone" within which there is the greatest opportunity and need for poor quality existing habitats to be restored, for the existing "core natural assets" to be extended, buffered and linked, and for new wildlife-rich green and blue spaces to contribute to the wellbeing and prosperity of people;
- calculate and demonstrate the social and economic value of measures to protect, enhance, restore and create habitats in different parts of the Network.

This **spatial plan for the environment** would ensure public spending and investments result in well informed decision making that is better targeted, more effective and delivers multiple benefits. It would also enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate

development sites. It would **enable more efficient targeting of public, private and charitable funding in the urban and rural environment to contribute to nature's recovery.** But, it relies on having access to up-to-date, comprehensive environmental geospatial datasets.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

In the Government's 25 Year Environment Plan[6], they committed to "develop a Nature Recovery Network providing 500,000 hectares of additional wildlife habitat, more effectively linking existed protected sites and landscapes, as well as urban green and blue infrastructure" and that "we will develop maps and advice to show where actions to improve and restore habitats would be most effective".

A Nature Recovery Network is a joined-up natural system of places important for wild plants and animals, on land and at sea. This network of interconnected wildlife-rich places allows ecological processes to function. It includes all the places where these processes contribute to flood-risk management, carbon storage, improved air quality, water purification, outdoor recreation, community cohesion, cultural inspiration, education, health and wellbeing. It brings value to people.

The *Making Space for Nature* report[7] (2010) made a very strong case for a different approach to nature conservation in England. The Report concluded that England's wildlife sites that currently make up our protected area network are too small, too fragmented, too few in number and not managed well enough.

Work done by the Natural Capital Committee, chaired by Professor Dieter Helm, demonstrated that the social and economic value of a healthy, ecologically functioning network of places that are rich in wildlife would be extremely high. For example, there is a large and growing body of evidence that improvements in the natural green and blue space in and around our most disadvantaged neighbourhoods would bring the greatest social benefit from a health and wellbeing perspective.

A geospatial approach is essential to realising this vision. It matters where new habitats are created and how they related to existing wildlife sites. It matters how plants and animals move around the landscape and how networks of natural greenspace join our towns, cities and urban neighbourhoods to each other and to the wider countryside. All those with a stake in nature's recovery need to share a common understanding of what

[6] HM Government (2018) *A Green Future: our 25 Year Plan to Improve the Environment*.
[7] Lawton J. *et al* (2010) *Making Space for Nature: a review of England's wildlife sites and ecological network*.

needs to be done in real places. We believe that nature's recovery will only work if there is a statutory requirement to map nature's recovery and all parts of Government are required to contribute to the development, maintenance and implementation of spatial maps.

These maps and a clear spatial plan can then be used to ensure the necessary investments and public spending (e.g. public health spending, agri-environment payments) are targeted in the right places to maximise the environmental, social and economic benefits. Through collaboration, this will help realise multiple benefits in real places. For example, it enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate development sites. The maps could also be used to support the improvement in public health by increasing regular access to nature for all. Natural England has estimated that if every household in England were provided with good access to quality green space (enabled in future by creation of a Nature Recovery Network), it could save an estimated £2.1 billion in healthcare costs[8].

We believe **Nature Recovery Maps** (to support the Nature Recovery Network) need to be "owned" by long-standing, stable public bodies with a wide range of existing duties and responsibilities. They would need to be owned by local stakeholders and based on high quality data mapped to a high degree of precision, and to benefit from significant support and input from a wide range of public bodies and other organisations. To us, **Local Authorities are the obvious bodies to take on the task of producing and 'hosting' the maps, bring together all the other significant stakeholders.**

The Natural Environmental and Rural Communities Act (2006) placed a duty on public bodies to have regard to biodiversity. However, many have down-played and under-valued this duty and it has demonstrably failed to prevent the continued loss of biodiversity related to the business of most public bodies. Local authorities do not have joined-up mapping systems that are regularly updated and used by all staff and are not currently required to map planning application footprints and then the actual land areas developed. If this information was captured and then shared, cumulative impacts could be better taken into account.

Nature's recovery will only happen when public bodies are required to use effective tools (including spatial mapping) to support their activity. **We believe the duty on public bodies should be strengthened to include contributing effectively to the development, maintenance and delivery of Nature Recovery Maps and plans**.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

[8] Natural England (2009). Technical Information Note 055 – 'An estimate of the economic and health value and cost effectiveness of the expanded WHI scheme 2009'

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

A **spatial plan for the environment** would ensure public spending and investments result in well informed decision making that is better targeted, more effective and delivers multiple benefits. It would also enable better and faster decision making on housing and commercial development and infrastructure, by providing robust and easily available information on risks, opportunities and synergies to help plan land use and allocate development sites. It would enable more efficient targeting of public, private and charitable funding in the urban and rural environment to contribute to nature's recovery. The existence of such maps would bring benefits in the improved targeting of advice and other effort related to a number of central government strategies (such as the National Pollinator Strategy). It could contribute to cost reduction in various public-sector areas, for example by aligning green infrastructure provision with those areas suffering from health inequalities, and by informing rural and farming subsidies to secure the most effective delivery of public goods. By combining environmental and social data this mapping will benefit businesses, the public sector and the environment sector, helping to plan and locate activities and projects in a way that will deliver better outcomes and give the highest return on investment, whilst having a net positive impact on the environment. **This approach would benefit all high-value categories** identified in the Call for Evidence document but especially property and land, infrastructure and construction, mobility and natural resources.

The role of Nature Recovery Maps in providing specific spatial focus would enable more **effective and efficient investment of "environmental net gain" funding from developers**. In addition, the National Infrastructure Commission is tasked with identifying strategic infrastructure needs that would enable significant opportunities for economic development. As part of work on a Nature Recovery Network and a framework for a national ecological network map, The Wildlife Trusts are in the process of piloting this mapping approach for the proposed Oxford to Cambridge Expressway and associated development. The map could then be used to target infrastructure and investment and ensure that the associated housing, commercial development and infrastructure development contributes positively to nature's recovery. The approach and spatial data sources required is set out in more detail in Question 14. The proposed mapping approach can be easily scaled up or down or 'cut' for different geographic areas.

If the Government is to deliver the agenda set out in the Housing White Paper, the 25 Year Plan for the Environment and to meet its ambition to be "*the first generation to leave the environment in a better state that it found it*" it will need to ensure that housing and related infrastructure is delivered in a way that delivers a net gain to the natural environment and enhances natural capital. Development should retain and enhance nature's ability to deliver a host of services, such as flood water storage, water resource

management, and pollution reduction, and provide homes with access to nature to promote health and wellbeing. This can only be achieved by taking a spatial approach, using the best available geospatial datasets, to planning and implementing Major Infrastructure Projects. These maps would allow nature's recovery to sit alongside economic development as a legitimate purpose for the planning and development system.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	thinkWhere Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	**X**
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definitions as shown are slightly confusing.

Geospatial data – "place" brings connotations of a place, literally. Suggest you change place to location

Positional data for me is literally the coordinates that define a precise location e.g. GPS coordinates, map coordinates and so on. Falls under geodesy/geodetic data.

Geospatial identifiers – identifies a unique object by means of a reference ID that can be associated to a geospatial data feature, thereby linking non spatial data to geospatial data

Geospatial services – these are not data types per se. Geospatial services to me refers to the various protocols for publishing and sharing geospatial data as web services.

In summary, for me, you have the underlying coordinate referencing system that allows you to precisely define position. Positional data refers to the coordinate data that identifies the precise location of the geospatial data – those real world features and objects where location is a key feature of its source and/or use. Using geospatial identifiers for these features and objects allows you to then link non-spatial data to these geospatial features and across different business

systems.
Collections of geospatial features can be published as web services e.g. individual datasets or data layers.

Defining “Linked Data” would be worth adding.
And you may want to consider the distinction between datasets and data layers.

I also think providing some examples against each definition would be helpful to illustrate the point.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Digital skills need to start from school onwards – geospatial skills are slowly becoming better established in primary/secondary schools but there’s a lack of current knowledge and insight from teachers. We need to provide better resources to support teachers and be better at integrating digital skills into the curriculum and within that, ensuring that geospatial skills are incorporated. This could be an opportunity for greater industry/education collaboration – identifying best practice and applying that in a more consistent manner across the board.

I am also aware that at graduate and postgraduate level teaching today, much of the material and focus is out of date – the pace of change is rapid and universities often don’t have the time to keep abreast. Also, we tend to proliferate teaching on one specific GIS software suite (ESRI) and this should be complemented with better access to and support of the excellent range of open source geospatial technologies, cloud computing resources etc. that are available.

There is a greater than ever convergence taking place between mainstream IT and GIS so topics like software engineering, coding, cloud computing, data science, data analytics, sensors/IoT etc. need to be much more to the fore. We’re also witnessing the emergence of AI and ML – these will have ever greater resonance within the geospatial world and we need to start laying the skills down in these areas.

Initiatives like Codebase, Codeclan, CENSIS and DataLab in Scotland all provide avenues where geospatial skills could and should be incorporated – such that geospatial becomes much more mainstream in the DNA of our digital economy.

It’s all about the data – we tend to overlook the importance of good data governance and the fundamentals of data management – these skills are more important than ever. We can have the best technology in the world, but need to ensure the data is fit for purpose – I still see a lot of poor quality data collection and maintenance and we need to educate both those responsible for data collection, creation and maintenance in good practice and importantly, educate middle, senior and executive levels on the importance of data as an asset that

needs to be managed like any other asset.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Within thinkWhere we've transformed from a "traditional" GIS consultancy to a GIS software and technology business. We've introduced agile Scrum methodology, DevOps processes and procedures for software development and enterprise architecture skills for platform design and cloud computing. These were all new and very different from the "traditional" skills our GIS developers used to have. These are skills that will continue to grow in importance as we look to the future.

At present it's very rare to find individuals who have these software engineering and coding skills as well as the core GIS skills. As mentioned in Q2, more could be done in the university curriculum and more could be done via technology incubation services and innovation centres, via digital skills and coding academies, via college digital and creative skills courses etc. to raise the awareness and understanding of geospatial.

Big data, data science and data visualisation are also key skills that are going to grow in demand and we need to see much stronger cross-fertilisation between geospatial and these related fields to develop the combined skills needed for geospatialists of the future.

We need to look at better ways of preparing the next generation with the digital and geospatial skills required in a future where geospatial data will be omnipresent. To date, we've been too introspective, there needs to be greater industry/education/academia collaboration, stronger collaborations with related industries and professional bodies in these sectors etc. If we look at the prominence that BIM has achieved over the last 3-5 years, we should be able to do this and more for geospatial!

I also think we could be doing a lot more to raise awareness and understanding of geospatial as part of economic development strategies – we need to elevate recognition within local and central government and with economic development agencies as to how essential geospatial is to the future of society, the economy and the environment. At present, geospatial is either assumed to be about maps or isn't understood at all. Creating better awareness and aligning the contribution geospatial can make to social, environmental and economic outputs and outcomes will stimulate more demand.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Depends how radical we want to be. Arguably, all geospatial data collected by government departments and agencies at the taxpayer's expense should be made openly available – this would create a massive stimulus to use and reuse of the data, unlocking economic value in new and unimagined ways. This would require such significant structural change and long term timescales that it is more a pipe dream!

The role and status of the Big 6 should be clarified as to the work they do as part of the "national good" versus that which is commercial – using OS as an example, as a government owned company they are now effectively competing with their partners in the market. The more we prime OS with additional government funding to either do things they should have done already (i.e. open data publication for INSPIRE) or funding to start providing new/additional services that compete with their partners, the more confusing the situation becomes. Partial opening up of datasets such as OSMM exacerbate the situation – hooking customers to a service that they then need to pay for, creating revenues for OS and potentially making it more difficult for partners to provide competitive services. We need real clarity to have confidence that it is a level playing field and not an anti-competitive situation, benefitting from State Aid.

Licencing is still a major headache for end users of data – there are many different licences in use, licences can be complex, difficult to understand or apply, providing a real barrier to the uptake and use of geospatial data. This area needs simplification and standardisation. OS licencing is particularly onerous – although it has been "simplified" over the last few years, most of our clients do not understand it and it proves to be a real barrier to uptake and use of their data.

We also need to make sure we take a wide look at the geospatial data landscape – it's not just about the Big 6. There are many more public sector producers of geospatial data – at local, regional and national levels and it's important that the Commission looks to this wider landscape of geospatial data to identify and support initiatives for improvement in use, access etc.

In terms of specific datasets that are difficult to access – some of the key ones would be flooding data (SEPA), land titles (RoS and HMLR), LiDAR (Scotland), nationally consistent planning data and importantly **all** utility datasets – these are traditionally very difficult to source yet essential to all development projects across the country. Ideally, these datasets should all be made available via APIs as online web services, with the option for data download.

Although there has been a big push on local and central government to open up

their data, and a lot of the focus has been on geospatial data, it's still difficult to find the data and, more importantly, to find out when it was last updated or changed. We have a plethora of geoportals or data portals at local, regional and national levels and we need to simplify/make it more transparent for end users where and how to find geospatial data of interest and how to find out if and when it's been updated. Most of our commercial clients employ full-time resources to undertake this task – a very inefficient use of resources, many times over.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Standardised, structured addresses – made openly available – with shared unique identifiers would be a game changer across the public sector and private sector alike. However, I've seen the ongoing "battles" between OS, Royal Mail and local government played out over the last 20 years and we still don't seem much closer to a resolution for open addresses. I think real structural change would be required to make a difference.

Whilst addresses are fundamentally important to service operation and service delivery across a wide range of public and private sector functions, we also need to look at how we consistently and intuitively reference non addressable buildings, features and locations. For example, as we deploy IoT sensors, they will very often be in non-addressable locations – the same can be said of wind farm turbines, solar arrays and so on. We need to have a simple, easily understood method for non-addressable referencing – people still get confused by grid coordinates. What3Words is one attempt at removing the complexity and may be worth further consideration.

We also need to think about the third dimension in addressing and how we uniquely locate features and objects in 3D space – this is going to become increasingly important.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Earth observation data will play a very significant role across many different industry sectors. At this stage, there is an awareness gap in the UK on what data is available and what you can do with it. Developing the UK's capability therefore needs to include education and awareness – with demonstrator/pilot projects to show what can be achieved.

Through a combination of application ready EO data and AI techniques, there is

strong potential to save costs, to improve decision-making and to potentially export the skills, knowledge and expertise to a wider global market.

We also need to be training and equipping graduates and others in the workforce with the requisite skills to manage and use EO data and practically translate its application to tangible business benefits.

For public services, in the same way that framework agreements have been established for OS data, it would be advantageous to establish something similar for EO data, thereby avoiding overlapping and duplication of costs/effort, introducing economies of scale and creating a stronger, collaborative community of interest.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There is a wide spectrum of maturity in the use of current technologies for geospatial data and services. The use of cloud computing, harnessing/driving the improved use of cloud native technologies, API's and web services is still, for many in the market, very new. We need to continue to push the benefits and opportunities of service-orientation, interoperable API's and data standards to maximise the potential for streamlined and efficient use of geospatial data and services.

We need to encourage government data publishers to make their geospatial data available via open, documented APIs and improve the mechanisms to catalogue and search for these services.

We need to strongly advocate and encourage open standards throughout and work with the GIS industry to ensure the adoption of these standards is established.

We need to more proactively promote the benefits and opportunities of open source geospatial technologies – these are now mature solutions that provide flexibility and a growing community of interest for knowledge sharing and innovation in solutions.

Increasingly, integration is going to be one of the big keys – geospatial does not sit in isolation but as part of an organisations wider information environment. Easy and straightforward ability to plug in geospatial data, web maps etc. to other business systems and applications is essential.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The planning, design and appraisal of technical and business options for investments such as 5G, IoT networks, electric charging point networks, renewable energy etc. all require a significant degree of spatial planning – developing models that integrate a wide range of geospatial and non spatial data to determine optimal locations and/or routes for these core future technologies.

Agri-tech, smart cities and new technologies in logistics are all directly enabled by the application of geospatial data.

As we look to a future world of autonomous vehicles, these will be highly dependent on precise, detailed location-based data to provide the digital twin/real world representation that they need to operate. Many car manufacturers are now investing heavily in digital mapping technologies to collect and maintain the underlying data – and generally to a higher specification than that of the equivalent public datasets.

The UK's economic growth will be underpinned by geospatial data and services and it's essential that we elevate the profile of the value and contribution.

We should be looking to Innovate UK and the various catapults as a driver for where/how geospatial could/should fit into future technologies and wider market sectors. Innovate UK and the UK Innovation Centres would also provide a great platform to publish and manage geospatial competitions and opportunities – making best use of the prime funding for the Commission.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

On the one hand, the geospatial data collected by the public sector is collected for an existing purpose – maintaining and enhancing this data should really just be done as part of an inline process. On the other hand, recognition of the importance of data management and data as a key business asset is highly variable, often leading to substandard data quality. Further, the specification of geospatial data collected to meet an in house process may not ideally suit the wider market and internal funds to extend or improve it for purposes beyond that which it is being collected for is a hard argument – especially with public services under a constant budget squeeze.

Public bodies should be committed to maintaining and developing the core geospatial data they need to fulfil their business processes – formalising what should be happening already. Where there are needs that go beyond this, consideration could be given to funding these enhancements in the same way that OS and other large national departments/agencies receive government funding to improve and develop its products.

The model used by the PSMA in Australia could be worth considering – datasets that have wider commercial value are licenced commercially with a revenue return to the contributing organisations. However, establishing such an arrangement across the hundreds of local government organisations would be a long term challenge – it's already taken years just to get to the point where addresses and streets are becoming available under such a model.

This approach also raises the conflict between open data, data that is free at the point of use 'v' commercially licenced datasets.

Businesses will pay for value-added, consistent, complete data that can be relied upon.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

On a broader scale, we still suffer from broadband hotspots across the country, making it difficult if not impossible to access web mapping and GIS on the go. A lot of our clients go to lengths to find workarounds for offline geospatial data and digital mapping. Ideally we need 100% network coverage of super/ultra fast broadband to support frictionless use of geospatial data and services.

One of the next big things will be IoT networks – the Scottish Government has very recently approved £6m towards a LoRa network. As we move towards smart cities and a sensor driven world, using location to view, analyse and model sensor data in real/near real-time will be an increasing priority.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We need to first determine what are the "core reference geographies" – those geospatial datasets that form the foundations of the UKs spatial data infrastructure and should be developed and maintained by the public purse. We should also map and define the geospatial data collected as a result of legislation, regulation or other statutory requirements (e.g. list of roads/highways), again data that should be developed and maintained by the public purse.

There is a key role for the private sector to then use these core datasets to create added value products and services – this is where the market will drive innovation and competition, creating and unlocking new economic value. We need to make

sure that the public bodies, including the Big 6 have a clear delineation between these public purposes for developing and maintaining core geospatial data and the prospective commercial operations of the same organisations.

With the rise in autonomous vehicles we are going to find increasingly detailed street networks and street asset datasets that go well beyond the content specifications of the OS. In an ideal world you would like to see the real/near real time change intelligence being collected by the car manufacturers feeding its way back to the relevant public authorities – local government, highways authorities and OS etc. to complement the core reference data rather than repeat the same/similar data collection under public auspices.

Public/private collaborations or joint ventures could be bigger in the future – the public bodies bringing their extensive geospatial data knowledge and experience together with commercial partners to extend the scope and content of new or value added geospatial data and sharing in the resulting revenues.

We should also look at the alternative business models adopted by the likes of Uber, Mapbox etc. and see what we can learn and apply to do things differently in the geospatial industry in the UK.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Yes – the key challenges include :

Sourcing data – especially in local government. Data can be published on public websites, geoportals or not at all and can rely on knowing who to contact and what to ask for.

Quality and consistency – again, especially in local government where, beyond addresses and streets data, there is little in the way of common standards agreed for the many geospatial datasets created by Councils.

Aggregated datasets – a lot of our clients require regional or national level datasets from local government – there are very few nationally aggregated datasets currently available.

Change management – it is very difficult to determine if/when a published geospatial dataset has changed – the minority of public sector publishers make this information available, sometimes providing a helpful RSS feed. However, in most cases this information is not provided and we/our clients spend a lot of time

and effort checking multiple different websites to compare with the current data. This is highly counterproductive.

Improved, but minimal, metadata would help along with adoption of consistent practices for publishing data and use of catalogue services.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission needs to be completely independent of the Big 6 and objectively determine the problems, needs and challenges faced by the wide range of public sector consumers of geospatial data – clearly understanding the outputs and outcomes that the data is needed to support. This perspective should draw out the core geospatial data requirements, mapping these against the current offerings to provide an informed and meaningful analysis on where/how these geospatial data needs are best serviced, where the key gaps are and where interventions may be required.

We need to avoid, as far as practical, falling into the trap of just doing more of the same or similar, playing at the edges and not being bold enough to consider new and different ways of creating and delivering the geospatial data that meets the current and future needs of the public sector. This may mean a much greater degree of data, system, process or organisational integration between the core data suppliers (which are not just the Big 6 listed as Scottish and Welsh devolved departments and agencies are just as vital a part of the mix).

We also need to look at private sector capabilities and offerings – it may be more cost effective to pay for new/enhanced geospatial data rather than invest in the public sector bodies to do what the private sector may be able to do quicker and cheaper.

With the public sector being a very broad landscape, consideration should be given by the Commission as to the best way of representing these wide and varying use cases.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Not sure what is meant by this question and why the focus is solely on the public sector?

A lot of the untapped social, economic and environmental benefits will arise from the private sector – there are great innovations, applications and uses of geospatial data in retail, insurance, logistics etc. and we should be looking outwardly to these sectors for inspiration and opportunity.

For example, Glenigans and Barbour both compile national planning datasets from the many public sector sources – this national dataset would be immensely valuable and useful to the public sector itself. Should we be considering creation of the same/similar dataset within the public sector or collaborating with a private sector partner to achieve this?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

We need to have a clear objective on the scope and purpose of a single UK strategy. Why do we need a strategy, what elements of the strategy are truly UK wide e.g. core reference geographies, versus what elements are not e.g. where different legislation or regulation applies etc.

We need to understand what geospatial strategies are already in place at the national, devolved and regional administration levels. Looking for good/best practice, stage of maturity in strategy delivery etc.

We also need to look wider afield to best practice approaches for geospatial strategies across the world e.g. the United Nations Committee of Experts on Global Geospatial Information Management to ensure that the strategy considers all the dimensions that collectively make up an effective strategy – people, process, data and technology – with a clear focus on objectives and outcomes.

We need to ensure we look beyond the traditional users and uses of geospatial data – previous strategies have tended to look inwardly too much and focus on the public sector and public sector data. We should be looking at the private sector a lot more where there are innovations in the application and use of geospatial data and services.

We also need to align the geospatial strategies much better with other, related strategies and initiatives e.g. UK Industrial Strategy, Govt Construction Strategy, Scotland's Programme for Government and Digital Strategy etc. to broaden the appeal and recognition of the importance of geospatial to delivery of these.

Careful consideration will be needed on the governance arrangements during

strategy development – ensuring the devolved and regional administrations are adequately represented and have a meaningful voice at the table.

Overall, the regional and devolved spatial strategies should be key building blocks of the UK wide strategy – ideally integrating these with one vision and with aligned delivery objectives and priorities.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Over the last 5-10 years we have seen a significant development and improvement in the use of GIS and location data by local authorities – as part of Channel Shift, Citizen First etc. web mapping and online spatial searches etc. are now used by most Councils as part of their self-service offering to the public. SOCITM has been a key driver in advancing this.

However, local authorities are still not unlocking the full potential of their geospatial data and there are numerous opportunities to improve public engagement and service delivery with innovations like 3D and augmented reality for planning applications etc.

There's still a sense that, at a strategic level, the importance of geospatial is still not fully recognised – local government leaders e.g. SOLACE, Digital Leaders groups/forums all need to be better exposed to the benefits and opportunities of using location data for public service delivery and excited by the art of the possible with the most recent technologies – going beyond the basics of "where's my nearest" or "how do I get to" and into "what if" and a more interactive form of public engagement powered by geospatial.

There are already numerous communities of interest within and across local government – GeoPlace, the Improvement Service, COSLA, Local Govt Association, various forums, Knowledge Hub etc. that provide a degree of coordination and sharing of best practice.

Consideration to funding a suite of new, innovative demonstrator projects as touched on above could be a very useful tool to entice awareness and interest on the new possibilities. Equally, initiatives like CivTech, GovTech and local government open data challenges (ODI) would help to develop new ideas, share good practice and stimulate opportunity.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**

- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Not entirely sure what is meant by this question.

Digital engineering and the integration of GIS and BIM for infrastructure and construction
Compilation, publication and access to national registers of vacant, derelict and brownfield land
eConveyancing

Q18: Are there any other areas that we should look at as a priority?

Renewable Energy
Healthcare
Agri-tech
Insurance
Retail
Disaster Management and Emergency Response

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Autonomous vehicles will have a huge reliance on geospatial data with a richer content specification and higher degrees of accuracy.
Smart cities and the expansion of IoT sensors into all walks of life – generating huge volumes of data about people, place, movements and events.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

We need to showcase existing good/best practice and make it easy to discover and access these resources online – ideally through a single gateway rather than having to search multiple sites to find the resources.

We need to proactively promote our activities and increase our profile at international events.

We need to establish/build on connections with groups such as the Group on Earth Observations.

We need to look for opportunities for knowledge and experience sharing with international partners and colleagues using existing networks.

We need to look for collaborative project opportunities whereby we can involve ourselves in global projects and initiatives.

We should look at the opportunities to work with our development agencies international arms (e.g. SDI in Scotland) to explore opportunities for international promotion, trade visits etc.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The USA for their NSDI and landmark geospatial policies
PSMA Australia
e-Estonia – most advanced digital society
UNGGIM
Oman National Spatial Strategy
The Humanitarian Data Exchange – humanitarian sector generally for good examples of cross project collaboration
British Columbia
Take advice from the OGC

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Transport Scotland
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**X**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The four types that have been identified are correct; although I would argue that your type "Geospatial Data" and "Positional Data" are an artificial partitioning of Data that has an element within it that identifies where the data is located in 2, 3 and even possibly 4D.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In further education, the understanding of the ability to join data sets together is taught well, but the emphasis of these joins is where the data has an attribute (column) in common. For those education courses where these digital skills are taught, the concept of using a common attribute which is not as column within either of the tables (the location of the observation) can be used to join the two datasets. This limit is artificial due to the way that the courses are designed and taught. Some of the obstacles to this are being eroded with the spatial versions of Commercial databases.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In my organisation, the biggest single point of failure is resourcing the Data Management area of the business, specifically the understanding of the creation of Metadata.

This is an area that people are generally bad at, look at the "metadata" associated with this document. In this area of big data etc, being able to find the data will become more and more critical. Metadata creation for spatial will only become mainstream when the creation of Metadata for non spatial documents becomes second nature.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Ordnance Survey have a dataset called "Points of Interest" which is specifically excluded as part of the "One Scotland Mapping Requirement". To obtain this dataset, Transport Scotland need to go through a formal procurement process to find the Most Economically Advantageous Tender (MEAT), although this can be for a multi-year contract, the costs of this can require the formal (time consuming) processes to be adopted. The dataset is currently used sparingly (as and when required by large projects) rather than as a core dataset to allow us to build different reports from it. In addition there are licence considerations about the data and potential derived data issues.

Another dataset that would be useful to have would be a complete underground apparatus inventory. This would be helpful during the process of designing new infrastructure and would enable the designers to obtain the definitive information

from one source. At present there are multiple different sources for individual elements of the apparatus, for example telephone lines, water pipes etc.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

In summary, the current set of addressing data can be summarised as:

- Local Authority Corporate Address Gazetteers (in Scotland built to the Scottish Conventions (based on BS 7666) and England and Wales based on GeoPlace Conventions
- Royal mail have their own separate addresses
- Valuation offices have some additional data

From these data sources, the AddressBase product set of Ordnance Survey is built.

It is important, in our view that, the base information source for the Addressing products continues to be the Local Authorities as this is closest to the actual address, in addition they need to collect the information already for many other purposes not least Local Taxation.

Considered in the widest sense, the infrastructure that is used for Addressing is currently based on local copies of the Ordnance Survey dataset, which does add value to the Corporate Address Gazetteers. Technology is changing where non-GIS applications need to use AddressBase and provision of a mechanism to access the information as a service from the Web (API access). The details of the use cases that could be covered will need to be further investigated.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The main effort to support the Earth Observation (satellite) capacity building should be in the area of "Analysis Ready Data", where the multiple passes of the satellites are merged into one or more datasets under an Open Government Licence to allow the use and re-use of the data in innovative ways.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The Open Geospatial Consortium is working on a number of new or updated Geospatial standards. A number of these standards will make it easier to access and use the information that users may wish to consume. The standards are based around a number of newish technologies. The technologies have been in place for a while, but they are now being incorporated into the geospatial standards.

- Modern Open Application Programming Interfaces
- Use of Restful services rather than SOAP or related services
- JSON and GeoJSON

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

As the various modelling technologies that are being developed start to create more and more detailed models of the real world, geospatial data will become more and more critical to the success of the applications. Extract Transform and Load tools that support spatial and help movement of data between specific formats will become an important too in the armoury of the data architect and the Data Management realm.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Investment in the maintenance and further creation of geospatial data and services is a critical task of the public sector going forward. In the generality, the public sector should be creating data and providing services on the data. The private sector should be creating applications based on the services etc. The funding of the public sector data creation and maintenance where the large organisations need to be self-funding does create artificial limitations to the licencing of data both within the public sector and outside it.

In Denmark, the production of the equivalent of the OS MasterMap Topo dataset is funded by Central Government (Department of Finance) and the use of this

data set is mandated by statute. There is evidence from Denmark of the Private sector producing additional information on top of the Centrally funded data and taxation income to the exchequer coming about.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The UK Government have made substantial contribution to both the Space programmes of the European Union and losing access to the premium services for Galileo would be unfortunate.

In addition the UK need to up their game on the use of Registers and Registries, it is not clear at this point how new code and codelists are added to existing Registers that are identified in the various geospatial standards that are used. (Gemini 2.3)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The role of the private sector should be a supporting and complementary role to the role of the Public Sector. The private sector may be involved in the creation of the Public Sector data (where the Public Sector do not have the facilities to collect it (by tendering for the work)) but the data created would be in the ownership of the Public Sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The main areas of difficulties are as follows:

- Multiple different licencing regimes (OGL, OSMA/PSMA, CEH licencing, ….) – where a smaller set of more focused licencing conditions were available, re-use of data to create information will be eased.
- Finding the data that is needed. Although the UK has a Metadata catalog (Data.gov.uk), it is extremely difficult to use for finding spatial data. I would argue it is not easy to find non-spatial data either. Transforming the repository from its existing technologies into a more standards based repository (DCAT) will make finding the data easier (and will potentially allow finding of the data direct from well know search engines)

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The main thing that the commission can do is to listen to the Public Sector community. However it is equally important that the commission remember that the GI policy and data as a whole are devolved issues and the commission should work closely with the appropriate leads in the devolved administration to ensure that an England centric view does not emerge, given the relative sizes of England against the other devolved administrations.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

As identified in Q4 – access to underground apparatus may well be a useful data set.

In addition aces to the premium services of both Copernicus and Galileo would potentially be beneficial.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Rather than building a UK strategy to fulfil this purpose, building a UK Strategy Framework in which the 4 devolved ad Gibraltar can insert their more detailed (and relevant to their geographic area) strategies to produce the strategic direction for the UK. In generating the overarching framework the commission needs to work extremely closely with the devolved administrations (as well as Gibraltar) to ensure the framework will fit their needs as well as the Strategic needs of the UK.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Continuing the current practice of sharing information widely using a specific communication channel seems to be the best idea. Where Local Authorities join together into bodies, like the Improvement Service in Scotland, having frequent briefing and communication with those bodies is key to getting the messages out to the wider community.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

infrastructure and construction

It is impossible to discuss this area without consideration of BIM and the development from the 2D, to 3D of this environment. Further development of this area to 4D (time) and beyond is happening. Currently the various software suppliers have developed their own software to provide BIM models. Work is

ongoing with the OGC to build a common standard for the exchange of this type of information. The commission's support of bringing the BIM environment into a Geospatial standard will reduce the costs of transfer from one software supper to another. The determining factor will be what software is best for your application rather than which BIM model is best, as all BIM models will be based on the same standard.

Q18: Are there any other areas that we should look at as a priority?

Working with standards organisation to adopt new standards and to strongly encourage the adoption of the standards across the UK public sector which should drive the private sector in the same direction.

Although not specifically spatial, the better adoption of metadata generally is important. In the spatial domain, Gemini is a standard that is adopted in the UK, however the absence of a non-spatial metadata standard is holding back the public understanding of how to find data. In terms of a standard, we would suggest using the DCAT standard.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

At present the UK is represented by a small group of organisations at the strategic and standard setting levels. These are primarily from the Geo6. As an example at the most recent Inspire Conference, there were only 7 representatives from the UK, two of which attended as they have contracts with the EU to attend the conference. The UK needs to take a more active role in these bodies and we need to have a more diverse set of organisations representing the UK. This will help upskill the profession as well.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

As identified earlier in this submission, Denmark has made significant investment in the geospatial industry and it is believed that the financial benefits of this are starting to be seen.

Germany operates in similar space to the UK, where the Central Government do not have direct control over the generation of data and the “regions” have significant responsibility in the domain. The coordination the regions to create a pan-Germany picture seems, at least from the outside, to be effective.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	TSP Projects
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definition of data types seems accurate, however TSP Projects appreciates there is a very thin line between the first two. Further industry specific examples would make its understanding easier. Consider removing the words "Groups of individual" and "grounded in a particular place" from positional data definition to make the sentence clearer.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

TSP Projects identified a lack of skills in the following areas: Geospatial Data Management, Basic Cartography, Critical spatial thinking, Data exchange formats and processes.
Universities and Colleges should be funded to provide a stronger geospatial background and software agnostic fundamentals of the processes. Content not covered by academia should be picked up and developed by professional institutions.
Private sector businesses could benefit from tax breaks to provide geospatial training to staff.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Some of the skill gaps identified by TSP Projects are: GIS for engineering, Geomodelling, Geostatistics, Interpretation, Digitalisation and use of new geospatial technologies.
The most effective way to address them would be training (starting with Senior Management) and better communications between teams.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

TSP Projects has found the following list of difficult to access datasets:

- Biological datasets are not fully available (regional areas)
- BGS maps are not available (1:1000)
- Buried services are only available in PDF formats
- Access to Geo-RINM (Network Rail) database not available.

As a solution, there should be a single GOV site to access all information, making it easier to find. The price to access the information should be standardised across the different datasets.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Address data from different GOV bodies seem to be inconsistent. Adopting a standardised country wide (and across all industries) address system would enhance exploitation of geospatial information, facilitating exchange and interoperability.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Many businesses do not have the confidence, skills or budget to try out new EO techniques. In the short term, it is more efficient and less risky for projects to send surveyors out. To support an effective market, the government could provide grant money or benefits to businesses willing to try out innovative EO techniques, or deploy EO techniques and share the data for free in tested areas such as city centres where many different organisations and individuals will feel the benefit. This would help to promote change and make some small companies thrive.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

TSP Projects believes it is key to develop interoperability between current technologies to allow efficient collaboration.

As for new technologies:

- Multispectral high resolution mapping satellites for ground measurements.
- GIS as a tool to analyse information and obtain specific answers - combination with Big Data technologies for real time assessments supported by high speed internet.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Standardisation of file formats and workflows would allow better interoperability paving the way for future technologies. Empower open source developers to make technology accessible. Developing a solid base 3D dataset to support new geospatial technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Publicly funded companies should standardise their geospatial datasets and make them accessible to everyone. They should undertake a combined approach to information management to make the right information available at the right time.
Public funding for investment and enhancement could be provided through a freemium business model where casual or individual users have access for free but regular users pay.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Local grid with complicated transformations often reflect in time consuming side tasks. GOV could make tools available to overcome this exercise and make it more efficient (cloud based grid transformation services). Alternatively review and assess whether the local grids are needed or could be absorbed by other networks.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector should have an indirect role in populating the UK geospatial data. All geospatial information produced as a deliverable to a public organisation should be integrated into the UK system.
A GIS may be a requirement to obtain a building licence, however due to data protection the system should remain confidential and for the sole use of the local authority. Should an external party require it, then consent should be provided by the public organisation.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

TSP Projects has identified the following challenges:

- Data available in different CAD/GIS/BIM standards, making it hard to merge without spending a long time harmonising.
- Data available in different geospatial formats requiring works to transform from one to another.
- Some environmental data is not in the British National Grid coordinate system requiring lengthy work arounds.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

TSP Projects believes this could be achieved with better use of survey data, often paid for by the public sector then isolated on a project basis. Legacy survey data should be made available from one project to another. Considerations shall be made about risks, liabilities, etc.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

TSP Projects has identified the following datasets:

- OS data
- Public Rights of Way across England
- Conservation area data in shapefile format,
- Tree preservation order across all councils in England
- Flood risk data in Scotland
- 3D Buried services mapping
- Borehole Data, Building Information
- Acess to Geo-RINM (Network Rails GIS)

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

TSP advises to not be prescriptive, allow room for innovation but demand that information should be shared into nationally held databases and submitted by contractors working in the public interest.
Perhaps even a pay for access model for non public projects.
This should be a private/public joint venture with a data company

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Standardise geospatial systems across local authorities and within them. TSP Projects Environment team experience a large regional variance in terms of local authority environmental and planning data.
Establish forums for sharing good examples of geospatial data use.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would

particularly welcome responses from industry and other bodies engaged in these sectors.)

A good example developed by Jacobs is ProjectMapper, explanatory video in the following link https://vimeo.com/223200166 . Support the BGS in creating a national geotechnical database and make it mandatory for construction projects to submit data. Currently we have a lot of public sector GIS and GI information out there but it should be collated into one place/resource Data.Gov.Uk was a good starting point.

Q18: Are there any other areas that we should look at as a priority?

TSP Projects would advise to use GIS and Big Data to plan real time events defence (position of security teams, barriers, etc) and public health (epidemics, access to hospitals, etc).

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

TSP Projects can foresee the following:

- Autonomous drones for delivery/assessments and Autonomous vehicles for transport of goods and people. There are strong regulatory challenges ahead for both
- Geotechnical and Geological 3D modelling within BIM construction practices (GeoBIM) and its impact in construction
- BIM Level 3 and its impact in the built environment

Q20: How best can we make the UK's presence in the international geospatial world more visible?

TSP Projects would advise to host international conferences at UK major cities and to promote our engineering and geospatial capabilities in events abroad such as the prestigious INTERGEO in Germany.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

TSP Projects has identified:

- Japan for 3D geospatial visualisation
- Netherlands for 3D geological risk mapping
- Australia for underground services
- Dubai for technology innovation
- USA for geospatial control networks
- Spain for drones applied to engineering

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Tyne and Wear Fire and Rescue Service
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	**x**
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Education needs to give more of an emphasis on geospatial data

Do we need improved satellite GPS coverage

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Training on GIS systems within schools, colleges and universities,. Promote these opportunities via job centre, access to free courses for organisations/schools. CPD recognised courses

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

British Oxygen Cylinders BOC provide us with information on oxygen sent to people's houses but they do not use a UPRN or have up to date information.
Housing associations/hospitals providing information on times they have called an emergency service.
Shared resource for location of emergency vehicles
A national data set for roadworks

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Quicker way for local authority custodians to update address base information especially business names

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Flooding seems to be a bigger issue within the fire service and it would be useful to have better information on flooding and surface water flooding

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The role of custodian in local authorities seems to be getting less important and a lot of the custodians we speak to have this as part time roles. It would be good to have more clear guidance to how to correctly apply UPRNs as we have flats which have no Parent UPRN. We also have issues with unit location in large shopping centres e.g the intu premise in tyne and wear. Custodians seem to be more focused on revenue collection e.g. council tax than having correctly documented address information

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Sharing their data more openly.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Encourage the use of UPRNs

Make a part of Addressbase freely available

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Free training courses, increase awareness with governing bodies e.g. CFOA/NFCC

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Encourage local networking events

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would

particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	T&P Regeneration Limited
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	X
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Improve capability to blend digital geospatial data from different platforms/data sources
- Standardise geospatial marking (e.g. AGS development)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Gaps:

- Developed skills in blending 3D data from various sources.
- Constraints in AutoCAD capability, ease of use, speed of use.
- Computer processing and viewing power – and handling of large volumes of 3D data.

Opportunities to address gaps and promote careers:

- BIM promoted to include below ground factual and design data.
- Property sales portfolios to include 3D ground model links including all subsurface assets.
- Improved business links between Ground Investigation Companies and BIM consultants.
- Improved cross discipline communications. (investigator/designer/builder).

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Desirable improved datasets:

- Underground services – accurate and standardised location data (for historic and newly installed assets) would save time, improve certainty and reduce repetitive expensive investigative work to locate (often repeated by different parties over time). Reduction in strike implications could also be a major H&S benefit.
- Borehole data – open and simplified referencing and feature ID access. Easier access to the wealth of existing and available data held by the BGS on local geology via simplified and standardised referencing and modeling tools would improve conceptual understanding of sites, confidence in site specific studies, a further

means for quality checking, and greater confidence for regulators and stakeholders. It could also potentially minimise site investigation work/ expense/time and avoid layers of repeat investigation over time – providing there was a standard means by which information is fed back in.

Options to improve:

- Options to feedback discovery data into a central database.
- Improved personal geo-locating tools.
- Improved open access tools.
- Development of apps to facilitate above/view what may be available for a site with ease.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes!

- Standardise as much as possible, seeking opportunities to adopt a single geo-referencing code/format (AGS?).
- AGS is good for our industry, but could this be enhanced to include land area mapping/boundary definition standardised coding/digitising….

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- Enable easier access to accurate location data from cheaper handheld devices.
- Develop technology for more affordable geo-referencing equipment to support georeferencing in aerial drone surveys – without the need for another trade attending site to orient the survey.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Drones
- 3D digital (large data) ground modelling processing hardware and software
- BIM software
- Big data processing hardware

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Drones – improved ease of use and accuracy of data captured – leading to speedy, intelligent capture of data for a vast platform of business applications.

Underground services – use of common georeferencing would focus developments in how this information is best maximised… currently, non-standard recording of information makes future application design intangible.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Accessibility to point, line, 3D and spatial terrain historic and UK wide data in a common form which works commercially and in the context of site design and BIM.

Cleaning up historical data and standardising the recording of future data – all in a common format.

Creating and then managing/hosting the cloud based data storage infrastructure for future digital aspects. This would ensure security, access standardisation and control over the data usage.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

1) GPS – handheld and personal devices for use by investigation, design and construction teams – including improvements in accuracy.
2) Satellite receiving and data processing technology
3) GPS surveying geo-locating equipment – reduce expense.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- Review of strategic options (and what the priorities would mean for business)
- Pilot trials/tests of emerging developments - from a 'user' perspective.
- Grants/subsidies to roll out new data streams – to kickstart the –uptake of new data formats and useability.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Access to data – Single government managed data storage area.
Knowing what's available. (Ditto above)
Format of data – great variation. Standardisation required.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Partner with business (large and small) to trial improvements to geospatial data commonality, accuracy and ease of access improvements.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Baseline BGS data.
Baseline UK topographic/land survey data.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Keep the questions and aims simple.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Get business involvement to drive the links.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

As per answers above.

Q18: Are there any other areas that we should look at as a priority?

Low/zero carbon energy infrastructure

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Aerial surveying. 3D ground modelling.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Include 3D and below ground asset information in property portfolios as standard.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The Dutch – national sharing of geo-spatial geological information and improving data coding systems… by law – great!

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	University College London
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I would perhaps simplify this list – you have direct geospatial data (any data that has an x/y or other coordinate information) and indirect geospatial data (any data that, by linking with other data, can be geo-referenced).

(Both of these can include raw data but also analytical outputs, and the outputs themselves don't have to be geo-referenced – i.e. they are indirectly referenced (i.e. they can just be a number or some text but based on geospatial calculations and / or data)).

(The coordinate systems can be local (e.g. BIM), national (e.g. BNG) or global (GPS))

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Three levels –

1. Raise awareness of geospatial as a career in schools- not only in geography but also in computer science and other areas, and also via careers advice mechanisms.
2. The geospatial apprenticeship - to provide technical skills (how to drive the software, how to capture and edit data using the various tools available
3. MSc programmes – exploring what is under the hood and providing critical thinking/analysis skills at a greater depth – so where a geospatial apprentice might be able to make a high quality map from given data, an MSc graduate should be able to assess whether the data is fit for purpose and 'push back' the request or outline the limitations if this is not the case, comment on data quality, be able to integrate and interoperate data and systems and so forth (a similar level of skill should be present in any Chartered Professional)

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- (No skills gaps as such as we are a research/teaching organisation)

- Great need for greater awareness of all things geospatial across wider academia – could be achieved by participating in careers fairs at various levels but also organising dedicated events for prospective geospatial students and courses for non-geospatial specialists (e.g. engineers, civil engineers, architects, historians, anthropologists etc)

- Also important to promote geospatial as a career route in schools – there is a lack of awareness about this area – i.e. about careers as a 'geospatial engineer' or 'geospatial scientist' or 'geospatial data scientist'

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- BIM data is very difficult to get hold of (for use in GeoBIM integration) – both due to being held within private industry and also due to quality / interoperability challenges

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The current address ecosystem does not take into account future deliveries or the third dimension – e.g. for use by emergency services (which floor is Flat 329 on) and future drone-type delivery services (information from BIM or other 3D models required to denote specific access points for automated delivery).

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Some key challenges with this type of data:

1. Extracting information (as objects)
2. Managing change / time series data
3. Lack of algorithms to process the data in 3D – e.g. vertical interpolation

Along with ongoing research to develop the above there is a need for low-cost (or FOSS) software that can be used by non-experts to exploit this type of data, incorporating clear communication of the limitations of any algorithms. (Desktop GIS is too complex for non expert users)

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- 5G – a strong emerging use case for 3D and 4D data, coupled with BIM, in order to model placement of 5G antennae
- Integrated indoor/outdoor routing and navigation (requires low-cost generation of indoor models and also indoor navigation technology) – safety applications e.g. how a 'bank' staff nurse or doctor navigates their way around an unfamiliar hospital to locate patients and equipement
- Digital twin technology – to enable integrated noise, air quality, energy use and other sensor-based analysis
- 3D/4D modelling to generate integrated indoor/outdoor, above and below ground models (at multiple scales and levels of detail)

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Research into the consequences of poor quality / unavailable geospatial data – how much do mistakes or poor decisions cost the UK every year, how many people are injured, lose their lives – and hence by improving the data quality reduce this cost.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Integrated indoor/outdoor positioning
Low cost measurement devices to create 3D indoor and outdoor data
Research into data provenance, quality and data usability (and consequences of error/mis-use)
Ability to locate sensors and other IoT devices in 3D space

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released?

Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Main challenge is the lack of a single source of data for all organisations. A searchable list and map of what is currently available where would be an excellent starting point. Data.gov.uk works in this regard, but has a high barrier to entry as the metadata standards are relatively complex (e.g. INSPIRE) and not all data is available on this portal..

Also inconsistent data across different public sector organisations (e.g. the London Borough of Camden publishes a map of all the street lights, many others do no).

Perhaps have a low barrier to entry – a minimal standard – so you can publish data with title, keywords and source organisation (captured automatically) – and then raise the data up a 'complete information available scale' as more provenance information is added

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

It would be good to promote a change to a 'culture of open by default' – i.e. all data should be open unless there are clear reasons why this should not be done.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- Access to data produced by construction companies (e.g..geo-referenced BIM) would provide downstream benefits in terms of asset management within the public sector and beyond.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

- Simplified licensing model is required
- Federated data search – one portal linking to others
- Minimum standard of information about the data that should be provided – and that can be generated and updated automatically when the data is uploaded / modified

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Professional organisations such as the AGI could be helpful when coordinating this type of activity. Also a touring road show of 'best practice' going into the various local authorities – with the scope of both demonstrating best practice found in other authorities and also identifying best practice as the road show progresses.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Property and land: E-planning – moving away from PDF and 2D towards 3D, and hence the potential to automate checks on planning constraints – e.g. does the building exceed maximum height for this area, does the proposed extension exceed 20% in volume of the overall building, what shadow will be cast by this building

Property and land, infrastructure and construction: Asset management – 'where is asset A', 'what health/safety equipment will I need based on its location' (building on the ongoing activities in BIM)

Q18: Are there any other areas that we should look at as a priority?

Positioning and navigation

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

BIM
VR and AR
Transportation (CAV, Uber)
5G
Robotics/autonomous robots
Delivery drones

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- Incoming and outgoing exchanges at high level – e.g. geospatial expert participating in high level trade missions
- Presence at various international fairs, conferences and events
- Online presence – geospatial.uk – highlighting the range of activities with case studies and contacts
- Open invitiation to overseas visitors

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- The Netherlands has an extensive number of cases that demonstrate the benefit of a 'open by default' policy with geospatial data (e.g. Geonovum)

- In the UK BIM focus is on large projects/infrastructure – in the Netherlands, Norway, Sweden there is focus on BIM for planning/property development.

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Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UCL - Energy Institute
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X – but we work very closely with BEIS**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**X – we carry out a fair amount of**

	consultancy for BEIS applying geospatial analysis to energy related data

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

These 3 themes seem good. From our perspective/experience some of the lowest hanging fruit can be found in 2.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Encouraging/improving spatial literacy within some of the government departments could provide some early improvements. This could happen on many levels but from our experience of contract work for BEIS, handling energy based datasets (ESOS, RHI, Salix) – these are the products of government policy and contain highly useful spatial information (the locations where the applicants have implemented the energy saving scheme) in the form of an address. **Yet** despite BS7666 having been in place for over a decade these datasets rarely conform to the standard and often diverge wildly. Cleaning these addresses to match back to UPRNs enables detailed analysis of the success or failure of the policy by be able to spatially cross-reference the data with other sources – yet this is a hugely time consuming and tricky process. Simply encouraging or even enforcing government departments to adhere to the use of BS7666 / OSAB / assigning a UPRN whenever an address is used would, in our opinion spatially enable massive amounts of data that at present is difficult to analyse. We have been beating the drum about this for many years at DECC and subsequently BEIS.

I attended William Priest's presentation at RICS on Tues 16th Oct and was disappointed to see that the address based data did not feature in his talk, although I appreciate that the talk was to provide a general overview.

We have also previously talked to the Cabinet Office (GDS) in 2016 when they contacted us about the issue of addresses and energy meters (after an OFGEM response we had made). We presented our work to Rob Maslin and Lawrence Hopper (2nd June 2016) having been put in touch with Paul Downey by Jon Franklin (VOA). At the time they were exploring the possibilities of an open Address Register, and we shared our experience of address matching a range of datasets for our geospatial models here at the UCL Energy Institute.

We would be happy to continue this dialogue / bring the Geospatial Commission up to date with our work since 2016 if this could be of use, particularly with reference to helping geospatial contribute to the Clean Growth Strategy.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Spatial literacy and encouraging staff who handle data without realising the geospatial potential that it holds could be improved within our organisation. We have recently launched an MSc in **Energy Systems and Data Analytics** which is the first programme of its kind in the UK, combining the study of Energy Systems with Data Science and part of the course is a geospatial analysis component. But there is still more that we could do.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

We would argue that the VOA Rating dataset, which recently became available online, but according to the terms and conditions can only used to look at Business Rates whilst we would like to use it for energy based analysis of hereditaments. If government wants these types of data to be used for the benefit of the UK economy it has to release the data without these constraints of use. Our discussions with colleagues at BEIS have suggested that despite being a central government department, they might also be facing similar restrictions for future versions of ND-NEED and other data models that use VOA data as an input.

We are big users of several recent releases of useful data: Environment Agency LiDAR data, HMLR Inspire data, HMLR Price Paid data, BEIS releases of public access gas and electricity consumption data (at aggregate level) and MHCLG release of Energy Performance Certificates and Display Energy Certificates. Any improvements to these datasets would be of great benefit to us, as would the release of further data about the building stock.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We are big users of address based data in many shapes and forms, and I refer to my answer to Q2 in part for my response here.

Regarding the datasets we use I would say that by releasing the NLPG/OSAB as an open government license could be a large step in ‘freeing’ up the spatial element of address based data.

But we recognise that this would be far from simple to achieve (as per our previous discussions with [Text redacted] and [Text redacted] in June 2016.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

Aside from LiDAR and some aerial photography usage we are not experts in this field, although we would encourage any developments that could be used in energy analysis and reducing / balancing energy demand / achieveing the ‘Clean Growth Strategy’.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

This is hard to say and is probably best left to the market, but from a ‘geospatial energy data’ perspective, AI and Machine Learning are probably where some big developments are going to come from in attempts to address the Clean Growth Strategy.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Encouraging more OpenData will encourage new/future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Investment and maintenance itself could be encouraged by allowing some of these different datasets and organisations to bring different datasets together and exploit the synergy. For example HMLR Inspire data and Ordnance Survey Mastermap data and VOA Ratings data (although via OSAB VOA data can to a certain extent be related to Mastermap though there are limitations).

It should be simple to relate the three datasets to one another, yet it is currently a real headache. Relating them would not only provide insights but could also trigger each organisation to check for changes. For example, a change to MasterMap building polygons could trigger the VOA to revisit a premises to see how floorspace might have changed (resulting in new Business rates). The opposite might equally be the case (a significant change to floorspace data behind the rates might trigger Ordnance Survey to check their building outlines).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS is not an area of expertise for us although we are users of this data at times. Regarding indoor positioning, the roll out of BIM would be of interest to us. To that extent, a method for handling complex 3D data for urban areas would be of great interest (for example how should property ownership be represented in 3D when it is inside muliple occupant buildings).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

No strong opinion although the underpinning infrastructure should not be left to the private sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

I am repeating my response to Q2 and Q5 to some extent – but the key issue we come across is handling address based data from the public sector (environment agency, BEIS, MHCLG, GLA…) which is often poorly formatted and inconsistent. This data is often not thought of as geospatial, yet if it can be matched to a geospatial version of addresses (NLPG/OSAB) it can become far more valuable/useful.

Other geospatial data from the public sector we can handle because we have staff who can handle most data formats within our organisation. Clearly this would not be the case for many other organisations, who would struggle here although things have improved dramatically over the past decade.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

By encouraging / forcing different public sector organisations to produce datasets that can be cross-related. This might be by light touch regulation on all public sector datasets that have some kind of geospatial component. Enforcing the use of British Standards too (e.g. BS7666) across all government departments!

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

The Clean Growth Strategy is going to struggle to make big improvements without easier access to energy data and an ability to make sense of this in the spatial context. This is tricky since a great deal of energy related data is sensitive (either to the customer, provider or from an infrastructure basis). Providing access to government and other accredited organisations whilst maintaining the sensitivity of this data is going to be an increasing issue. A good example is the access to Smart Meter data – an issue that is currently being tackled by colleagues here in the Energy Institute (SMRP).

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

By providing good examples *from* central government and enforcing minimum requirements on any outputs that might feed up to central government or other datasets (as is currently done for LLPG → NLPG)

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

With all of these with the exception of maybe sales and marketing, achieving Clean Growth Strategy targets would return economic value. Our approach is to create geospatial models of the energy demand in all these areas. With better data it is possible to build more realistic simulations, and with these it is possible to both simulate policy and test the effectiveness of policy. From our perspective, applications which push the envelope in this area are to be encouraged. 3D geospatial can be of particular importance here in dense urban areas.

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Driverless vehicles

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By leading the way instead of looking for others to follow!

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

In terms of 3D models of the building stock Singapore and New York city have traditionally led the way.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UK Remote Sensing and Photogrammetry Society
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	**X**
Legal representative	
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Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The four data types identified by the Commission appear to adhere to the vector representation of the world, which is important, but sees entities as discrete objects. The four also relate to precise functions the data may be used for. These types do not adequately cover phenomena that are continuous, such as topography, and that are traditionally represented by a raster data model. The current types also do not really represent Earth Observation data, which comes in an image form, and can largely be described as raster. An additional type that describes data which is represented in an image format would therefore provide a more comprehensive coverage of Geospatial data types.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

From the perspective of RSPSoc members, the following areas of focus would be appropriate:

1. Education and training in order to ensure an adequate supply of appropriately trained and qualified staff. The number of taught university courses that focus on, or have a significant component of remote sensing content has been in decline for a number of years. Without these educational opportunities at all levels, in particular FHEQ Levels 6 and 7, it is likely that there will be limitations in skilled labour that will impact on growth in Geospatial industries. In the wake of the 1987 *Chorely Report* (*Handling Geographic Information*) there was a boost in the number of HE courses in GIS, and a similar encouragement is needed now.
2. Recognition of expertise in GIS and Remote Sensing is required. The status of schemes such as the RGS Chartered Geographer needs to be enhanced within industry sectors. Such schemes would have the benefit of encouraging re-skilling of employees within organisations through the requirements of CPD.
3. Policies that ensure the continued supply of certain data sets are required. If industry is to develop products around specific data sets or data products there needs to be long term guarantees of the availability of those data sets or products. The mapping of the UK by the Commissions six partners represent a longevity which needs to be replicated in other field. In the EO sector there is potentially a lack of longitudinal planning in terms of the availability of data sets. The current ESA-EC Copernicus mission represents the potential for such a longitudinal supply of compatible data. Policy/decision around the UK's involvement in Copernicus is required quickly following the UK's exist from the EU.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As a learned society RSPSoc has an overview of the potential areas that skills are required in with regards to Earth Observation.

Within the exploitation of EO there is clearly a requirement for those who develop and operator the various sensors and those that exploit the products coming from the sensors. Appropriate training and educational opportunities are clearly essential to support these areas. The current apprenticeships in Geospatial (the L6 *Geospatial Mapping and Science* and the L3 *Geospatial Survey Technician*) are very much built around survey and some GIS skills, and ignore Earth Observation. The development of apprenticeships for Earth Observation, and more broadly for remote sensing, would have an impact on generating both a skilled workforce and enhancing the visibility of career paths in Geospatial, and in particular in Earth Observation. Some consultation would be required about what

level the apprenticeships might be at, but an offering or two (if development of EO and its exploitation are split up) at Level 7 (Masters Level) would perhaps be the best place to start.

In terms of promoting careers in the Geospatial this is something that perhaps needs to be done at both School and University levels. The recent changes in the A level Geography curriculum has put a focus on Geospatial like never before, and this needs to be exploited. There are various initiatives going on, with organisations such as the Royal Geographical Society, the Geography Association and commercial partners, but these need to be supported and more linked up. At university/post-graduation level there are initiatives such as the AGI early careers (ECN) network, and the Space Placements in Industry (SPIN) which are promoting careers relative to Geospatial. These schemes could be broadened.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

As RSPSoc does not directly use data we are not in a position to answer this question fully, however members of the Society have indicated that greater access to up-to-date imagery would be advantageous. Anecdotally members have made use of the EA's LIDAR data sets, and something similar in terms of imagery would be very useful. The issue with data sets is ensuring a consistent coverage both spatially and temporally.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

This is really outside the core areas that RSPSoc represents.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Clearly a significant element in developing and enhancing the UK's capacity is continued engagement in Copernicus. Copernicus provides a very appropriate model of a sensor to product infrastructure for EO. An underpinning to continue supporting this initiative would be appropriate. However, the development of some capability to tailor the data products created through Copernicus would possibly lead to greater usage.

A potential issue with most EO products is the frequency at which they are produced. A step change in capacity would be to have more regular updates of products, such as UK Land cover/land use maps. For commercial organisation to base products on EO data sets those data sets need to be up to date.

A consistency in standards and processing of EO data would also be appropriate. Various standards, such as those through INSPIRE or the Open Geospatial Consortium, exist and these should be consistently applied to produce reliable products.

A gap in the Open Data available in the UK relates to airborne imagery. The OS now has its MasterMap Imagery layer and consideration should be given to how this might be exploited more effectively, and made available to certain user groups as open data or at low cost. Again the issue of updating this would need to be addressed.

As noted in previous responses there is also a need to build capacity in terms of suitably qualified individuals to take on the developments in EO. As noted in Question 3, the development of suitable apprenticeships at FHEQ L7 would be one element of this, but more specific allocations of research funding to dedicated doctoral schools through UKRC for FHEQ Level 8 provision is also needed in order to enhance cutting edge developments.

As part of capacity building the development of professional recognition of EO professionals would be essential, as already alluded to in a previous answer relating to careers (Question 3).

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Technologies that provide real time data are potentially significant. From an EO perspective this might be achieved through the fusion of a range of sensors or by exploiting constellations/swarms of small satellites. As a learned society RSPSoc cannot endorse any specific commercial organisation, but an example of the approach given above might be Planet.com, who combine their satellite sensors to provide daily coverage. The other major examples would be something like the Disaster Monitoring Constellation and of course Copernicus.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

The development of future technologies will partly be dependent on what geospatial data is available to "fuel" them. However there is also the development of future technologies that can lead to the creation of new geospatial data and applications. As noted above, the development of "cheap" constellations/swarms of small satellites should lead to the creation of more bespoke data. Further developments in the sensor suites carried by UAV, and other types of drones, will also further enhance data collection, which should in term drive new applications.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Potentially the role for the public sector is to maintain the key data sets that can then be exploited by other downstream users. The missing element in the current partners of the Commission, which are responsible for key data sets, is a body/representative to be responsible for EO. Whether a role for other government executive agencies, such as the UK Space Agency and the Met Office, who are large users of EO should be found should be considered.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

From an EO perspective the areas that should be focused on are positioning and calibration. The maintenance of a national network of GNSS receivers is essential for ensuring the accuracy of Geospatial data sets. Access to GNSS satellites is also essential, ideally from more than one constellation (i.e. not just GPS, but also potentially Galileo or other alternatives).

In addition, the development of calibration sites for satellite EO would enhance the UK's ability to produce pre-processed products, and potentially enhance the use of EO. A network of calibration sites, as explored by the NCAVEO (NERC Calibration and Validation of Earth Observation data) project, would greatly enhance the capacity in the UK to produce products that are ready to use. Further background on the development of such a network can be found at the CEOS supported project QA4EO (Quality assurance framework for earth observation).

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The public sector should be providing a basic infrastructure in relation to positioning and calibration (certainly in terms of EO), but this network could be enhanced by private sector organisations. The potential for public-private initiatives is great in this area. The role for the Commission should be to ensure that any infrastructure is in the national interest, and that both geographical areas and thematic sectors that are not deemed to be commercially attractive are also covered.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

This is a question that is not really applicable to RSPSoc as we have such a varied membership who will experience a range of issues in relation to accessing Geospatial data and services.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission's role should be to ensure that core infrastructure and data are available. There is also a role for the Commission to ensure the longevity and sustainability of core products and service. The nature of the private sector suppliers of Geospatial data is such that commercial consideration need to take priority, and ensuring the longevity of a particular data set is not necessarily a priority. The Commission's role should therefore be to identify core requirements and ensure that these can be sustained. In collaboration with agencies and organisations such as the Catapults and Innovate UK addition capacity can be created.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

From the EO perspective having the equivalent of national mapping made up of aerial photography would be a major step forward. There is a potential for such a layer of Geospatial data to be developed by a public-private initiative. Such a layer would have a cost to it, and a model of access which differentiates between total open access for some users and a charge for others would seem to be the most appropriate.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

There clearly needs to be an overarching strategy for the UK as a whole as geographical features and phenomena do not stop at the borders between the Devolved Administrations. The Commission should identify a series of core requirements in relation to the exploitation of Geospatial data, high amongst these should be interoperability in terms of both data and services. Core standards, along the lines of something like INSPIRE, should be identified for the collection, storage and exploitation of data. There should be an agreement on the way that core data sets are collected, updated and made available. The strategy should also be seen as a way of sharing good practice, and as the basis of the development of a core set of information for all DAs. The issues we are likely to experience in the future will be as a geographical region irrespective of the political configuration that exists at that time. Recent natural disasters have shown that nature does not respect political boundaries.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

This is not really a question that RSPSoc can comment on.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

This is not really a question that RSPSoc can comment on.

Q18: Are there any other areas that we should look at as a priority?

While perhaps not of immediate commercial value there is a need to consider how we monitor and manage the built and natural environment. The increasing frequency of extreme weather events has highlighted issues that need to be addressed around how we plan and develop the landscape. So while not necessarily commercial in terms of generating income, the potential to save lives and to save money is clear to see. There are also wider climate change problems that we should be looking to monitor and manage using Geospatial. Again the direct commercial value may not be visible, but the benefits over time will impact on society as a whole.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Regulatory challenges exist around the balance between the good of society and the need to preserve an individual's privacy. How GDPR will work with Geospatial information is still not clear. There is also likely to be challenges around the use of Geospatial data and ensuring there is equality in access to information.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

From an EO perspective there is already a great deal of respect and recognition for the work going on in the UK. The Commission's role should therefore be to ensure that the UK EO community/industry can continue to collaborate and engage with partners on the world stage. Some of the issues relating to technology transfer that have arisen out of the UK's forthcoming exit from the EU need to be addressed to ensure that the excellence in the UK EO community can continue to collaborate on an equal footing with other countries.

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UKHO
Job title	[Text redacted]
Address	[Text redacted]
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Please select which of the following best describes you as a respondent:

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Micro business (up to 9)	

Other – please state	

Call for evidence – three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

No:
- 1 should say "where place is a key feature of its subject" rather than "its source". The definition as written is somewhat ambiguous.
- 4 should talk about "insights, products and services", not just "insights and products".
- 4 should also be wider, e.g., "… involving the fusion and analysis of layers" not just "involving layers".

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Data Science (AI, ML and data analysis)
- Data Engineering
- Data Management
- Earth Observation
- Geospatial and GIS skills
- DDAT skills, especially Software Engineering

Individuals that combine these skills, e.g. data science with earth observation, or GIS with software engineering, are especially valuable. This multi-faceted aspect should be reflected in educational programmes.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- In our organisation we struggle to address skill gaps in data science, data engineering and software engineering, especially where those skills are combined with geospatial experience. This is largely due to a lack of such skills in the wider economy but something that could be addressed through greater collaboration with academia.

- Foresight Future of the Sea outlines that 'Autonomy and robotics' will challenge the UK's skills base and recommended the support of mechanisms to 'join up' diverse sectors of marine including around skills (Page 10 of Foresight: Future of the Seas). It also stated that analytical skills and greater coordination between marine sectors was key to enabling big data and driving innovation (Pg 14). In addition DfT Maritime 2050 strategy is looking at the challenges associated with getting the UK 'Marine Autonomous Navigation ready'.

- The creation of specific geospatial clusters in areas of comparative advantage (in our case a marine orientated one in the SW) would help to solve this problems by creating a self-reinforcing eco-system of Geospatial Partner Bodies, other agencies, local government, industry and regional educational institutions such as schools, colleges and university alongside private businesses. This type of effect and its benefits are seen most clearly in the UK in Cambridge.

- Leveraging on existing regional work, for example 'Digital Skills Devon' is already looking at issues associated with digital careers and the South Coast Marine Cluster (industry, Government, Local Enterprise Partnerships) is already promoting marine especially around autonomy and data. A Marine Geospatial Cluster and innovation centre in the South West would join up and enhance these existing initiatives and hence addressing issues outlined in the Foresight report.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- UK (both Gov and Private) marine geospatial data holdings are complex and held by many organisations. Often this data is collected for a single use and not published more widely. Simply requiring government agencies and private sector organisations, e.g. as a condition of planning permissions, to put copies of their data into nominated, marine data asset would ease this problem significantly. As an example, there are over 20 Government agencies, along with port authorities, local authorities and private companies collecting bathymetric (the marine equivalent of topographic) data in the UK and, whilst the UK Hydrographic Office is the authority for such data, it has no power to ensure that data is deposited and made available for other uses.
- Profiling and championing of the UKHO as the custodian of the UK Governments marine geospatial data asset is intrinsically linked to the effectiveness and value of that data asset i.e. it won't deliver on what we want it to if no one knows it is there or how to access it.
- Adopting common standards for naming, georeferencing and other metadata would greatly aid the meaningful collation, analysis and application of aggregated marine data such as bathymetry.
- The lack of a high resolution national bathymetric data set may become a barrier to the development and adoption of autonomous shipping in UK waters, which may in turn restrict the competitiveness of UK ports.
- Potential changes in regulation may be needed to ensure that data captured by private companies under license to HMG is automatically made available for wider use.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

- More thought needs to be given to the interface of marine and land data, especially in areas, such as ports, where effective economic activity requires the analysis of data from these two different domains.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- The UK's Earth Observation (EO) data capability could be enhanced by expanding the availability of low cost/free high resolution multispectral EO data. Currently the land centric approach to data collection means that its availability is restricted in coastal and offshore data for example the UKHO had to pay commercial rates for EO data of the UK Overseas Territories as part of the UK OT Seabed Mapping Programme.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- Improved EO sensor technology.
- Improved surveying technology, including autonomous platforms.
- The use of AI and machine learning to improve and extract insight from EO and survey data.
- The addition of geospatial functionality to key open source big data technologies.
- An area of focus should include the interface between the data owner/aggregator and the user. This often requires data to transfer between technologies and sectors; therefore, agreed API and appropriate metadata standards would be a key enabler.
- The use of distributed ledger technology (DLT), to ensure provenance and traceability, and smart contracts, to ensure frictionless use, could also be key enablers for the effective use of geospatial and other Government data.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- Autonomous shipping will throw up many challenges, this will include areas such as reliance on accurate bathymetric, weather and tidal models, routing information and more explicit depiction of restriction and constraint information (i.e. it will need to be captured and presented in a machine, rather than human, understandable way).

- DLT, machine interpretable or smart licenses will be needed to support an automated ecosystem of geospatial data suppliers, value-added analysts and end users.

- The UK still has a comparative advantage in the marine/maritime space. This status is reflected in the size and scope of 'Maritime London' as a sector, the only UN building in the UK is maritime focused (IMO), and NATO's Maritime Commander is also UK based. The UKHO's data asset is truly global covering a primary charting portfolio of 71 coastal states and it runs data collection programmes in over 30 of those.

- As such the availability and quality of UK marine geospatial data supports the development of UK businesses and technology both in the UK and overseas. For example, Foresight Future of Sea not only suggests that data collection activities need to be expanded globally (recommendation 20) that they should stimulate innovation (recommendation 19) but that autonomy and sea bed mapping are 'Key sectors to create a long-term platform for UK business to capitalise on growing global opportunities (recommendation 1).

- UK Government aspirations (DfT Maritime 2050 / FCO International Oceans Strategy – currently in late draft stage) to support a global mapping programme could be a significant stimulant to the development of surveying and data technology, including autonomous platforms. E.g. international develop policy and activity (and subsequent data collection contracts as seen by UKHOs part in the Commonwealth Marine Economies Programme) could stimulate the development of autonomous data collection methods.

- Foresight strongly outlines as part of its four structural issues (page 9) that of the trends and recommendations (economic, environmental, international engagement and marine science) are 'overwhelmingly global'. As such future considerations for how the Geospatial Commission approaches issues such as Governance and data platforms need to be cognisant of the broader, expansive and global approach that the UKHO's current activities need to have. These activities are predominantly UK and outwardly looking (and this is positive when it comes to UK businesses operating globally) rather than UK landward/inward.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

- Even with the increasing availability and utility of EO data and the advent, albeit at an early stage, of low-cost autonomous surveying platforms, the collection of marine geospatial data is extremely expensive.

- A more coordinated approach to the collection and dissemination of marine geospatial data would minimise duplication and maximise the value of every £ invested in collecting marine geospatial data.

- The UKHO believes that being able to generate value from its data is vital to the overall health of surveying activity. Additionally, it would be reasonable for the UK Hydrographic Office to run the UK Civil Hydrographic Programme (currently managed by Maritime Coastguard Agency) in order to better coordinate broader UK marine geospatial data requirements and deliver best value for money and data into the marine geospatial data asset.

- Foresight specifically recommends encouraging 'mechanism to address insufficient join up' (recommendation 4) and coordination between sectors to 'enable big data to be a driver of innovation' (recommendation 19). These fit well with Boston Consulting Groups unlocks (from the Digital Land review) which highlighted the 'Fix not regrets' issue of better coordinating existing activities including sea surveying (Unlock #6).

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- DGPS and its equivalents are essential to the economy as they drive a huge number of location aware services and data collection activities. There is currently a reliance on US, EU and Russia based systems and the UK should consider a UK based alternative.
- The UK should develop and enforce a full spatial data infrastructure (see ODI definition).
- Autonomous data collection systems.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- In the case of marine geospatial data; the UK private sector provides the majority of the data collection capability with services contracted in to support annual data collection programmes. Government should retain maintain responsibility where regulation, sovereignty (especially in defence sector and critical national infrastructure) and standards require this.

- The key thing with any private sector involvement is that it is not allowed to evolve into lock-in a proprietary solutions.

- In the context of enhancing, business is likely to be more effective at identifying the need to improve and then driving solutions and it is the role of Government to enable these activities rather than to try and predict.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- Foresight specifically recommends encouraging ‘mechanism to address insufficient join up’ (recommendation 4) and coordination between sectors to ‘enable big data to be a driver of innovation’ (recommendation 19). These fit well with Boston Consulting Groups unlocks (from the Digital Land review) which highlighted the ‘Fix not regrets’ issue of better coordinating existing activities including sea surveying (unlock #6).

- UK Governments marine geospatial data holdings are complex and held by multiple arms-length bodies. Often this data is collected for a single use and not published more widely. Simply requiring government agencies and private sector organisations, e.g. as a condition of planning permissions or managing shellfish health, to put copies of their data into nominated, marine data asset would ease this problem significantly. As an example, there are over 20 Government agencies, along with port authorities, local authorities and private companies collecting bathymetric (the marine equivalent of topographic) data in the UK and, whilst the UK Hydrographic Office is the authority for such data, it has no power to ensure that data is deposited and made available for other uses.

- The creation of specific geospatial clusters in areas of comparative advantage (in our case a marine orientated innovation centre in the SW) would help to solve this problem by creating a self-reinforcing eco-system of Partner Bodies, other agencies, local government, industry and regional educational institutions such as schools, colleges and university alongside private businesses. This type of effect and its benefits are seen most clearly in the UK in Cambridge.

- There is a lack of standards, lack of metadata, inability to determine what represents the authoritive master data set, the scattered nature of data and the difficulty in knowing what is actually available.

- There are also problems with restrictive licensing terms and have to pay royaltiies for data that has often been collected under license to HMG.

- The role and requirements of the Devolved Administrations need to be considered separately from ALBs and Central Government Departments.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- The Geospatial Commission should encourage more efficient planning of cross government marine geospatial data collection, aggregation and dissemination to avoid duplication of effort across the public sector to realise efficiencies and ensure that the UK has a comprehensive view of its marine geospatial holdings which can be used to best effect to support private sector enterprise.

- The GC should consider inclusion of marine products and services within its concept for the future Public Sector Mapping Agreement. For example, Crown Estates are currently purchasing UKHO products from the private sector in contrast to OS products which they get through the current PSMA framework.

- Where the GC gets involved in projects it should encourage the use of open geospatial standards and use of open source tools/code.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- UK Government has significant agencies that collect and aggregate marine geospatial data for multiple uses. This list has been provided to the Geospatial Commission. Access to that data would be via one UK national marine geospatial data asset. Arms-length bodies should be encouraged to provide their marine geospatial datasets to the UKHO who can manage the authoritative marine geospatial data asset.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

- Encourage stakeholder engagement and effective governance. Seek alignment or sort out the hierarchy of policy e.g. will the Geospatial Strategy sit beneath the Government Data Strategy etc; the policy landscape is confusing and needs to be rationalised.

- Regional variation will be subject to the topic covered; for example; discharging the UK's Safety of Life at Sea Convention requirements for the provision of maritime safety information and hydrographic services to support navigation are not devolved and are therefore uniform across the UK. An analysis of the implications of devolution will be required to ensure correct regional variation.

- Acknowledge that marine geospatial data is an enabler for understanding many other marine activities and challenges such as climate change, maritime security, plastics, disaster response, seabed mining, blue economy, tourism, defence, fisheries and aquaculture etc and as such needs to be reflective of their associated national and international strategies and policies (for example FCO International Oceans Strategy, DfT Maritime 2050 and UN Sustainable Development Goals).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

- Engagement with Local Authorities will be required to raise awareness of the opportunities associated with harnessing geospatial data. Raising awareness in this sector will be key.

- Delivery of a marine geospatial cluster and innovation hub will require coordination with local councils and the Heart of the South West Local Enterprise Partnership.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

- Need to ensure that these are not all viewed from a ‘land’ perspective and that they are interpreted in the widest way e.g. mobility covers autonomous shipping and logistics in general, infrastructure covers offshore assets and natural resources includes fishing, wind farms, oil and gas etc.

- Consider the impact/signalling of not including any aspect of marine at all within GC priorities (disengagement from marine geospatial stakeholders beyond UKHO).

- Marine Geospatial, autonomy and Innovation Centre would support industry ambition outlined within the South Coast Marine Cluster (notably marine autonomy)

Q18: Are there any other areas that we should look at as a priority?

- AI
- Autonomous shipping (and innovation) is a priority for industry and the UK Government (DfT Maritime 2050); this area offers significant opportunity for Government, industry and academia to work together to ensure that the UK capitalises on the opportunities associated with this technological revolution.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

- Regulatory changes will be required by the International Maritime Organisation (IMO) to make autonomous shipping a reality. UKHO is working with DfT to contribute to the ongoing work on autonomous shipping navigation regulations.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- Work with DIT to identify export opportunities for Government and Private sector services; e.g. the provision of Marine Spatial Data Infrastructure to other governments to help them manage their marine domains.
- Contribute to international geospatial for a e.g. the UNGGIM, raise awareness and note the contribution to international for a by the Government geospatial bodies, e.g. the UKHO's contribution to the International Hydrographic Organisation.
- Be at the forefront of geospatial innovation.
- AI

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

For an example of best practice consider the US Federal Geographic Data Committee (FGDC) https://fgdc.gov/ where the focus is on collaboration, partnerships, coordination, standards, metadata and interoperability.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UKRI
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X [Funding Organisation]**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Agree that these are an accurate view of geospatial data although an additional element may need to be considered for future use.

Geospatial data holds great potential for how we manage the environment and our natural assets (e.g. woodlands, tidal power) as well as our built and agricultural (crops, soil, water use) environment. Therefore an addition to definition of 'Positional data' which embraces that assets could be 'natural' as well as 'physical' is suggested as follows:

"Groups of individual datasets that usually have location as a secondary purpose, and which describes activity, physical **or natural** assets grounded in a particular place."

A relatively new aspect of geospatial data is the temporal element. Often the change in data, because of an update, has an additional value for research or commercial exploitation. In a historical context, this is clear but in modern digital and automated data collection, the temporal change element is the basis of exploitation of the data. This could be considered under the definition of geospatial services or even as a factor in its own right.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

There is a need for people with skills in data management, data use, as well as in model development which make use of geospatial data. Specifically this should extend to the use of Artificial intelligence, especially for computer vision and data analysis.

These skills are needed in academia as well as business to help ensure a strong pipeline of geospatial data (through academic research) and to drive business innovation through the exchange of data/knowledge. In agriculture in particular, multidisciplinary teams are needed to interpret data into useful information for farmers (for example, geospatial data could inform a farmer that more nitrogen is needed in part of a field; a robot could then apply more fertiliser).

It is important that these people have enough subject specific expertise to understand how to apply geospatial data to novel applications (i.e. what can the data, or combinations of data reliably tell us).

Further development of skills in modern digital data collection techniques, including satellite-derived earth observation, are required to capture the emerging opportunities relating to the application of these technologies.

There is a wider generic skill set requirement in understanding the power and value of geospatial data. This is an impediment to adoption as potential users do not realise there may be a geospatial solution to a given problem. The Geospatial Commission will be uniquely positioned to deliver a powerful public awareness message to government, business and the public.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Skills gaps
The Natural Environment Research Council (NERC), one of the research councils of UKRI, identified skills gaps within the environmental sciences research community (https://nerc.ukri.org/skills/postgrad/policy/skillsreview/2012/), in addition to this NERC has an open 'call' for evidence submissions for training needs (Ref: https://nerc.ukri.org/funding/available/postgrad/focused/cdt/evidence/). Many of these skills gaps are shared across UKRI and are relevant to geo-spatial data.

Skills Gaps:

- Data management

- Interrogating and interpreting large datasets and data mining
- Large scale data manipulation
- Understanding data integrity protocols and assurance
- Understanding and managing uncertainty (in data and products derived from data)
- Numerical and mathematical modelling
- Statistical methods for handling, analysing and interpreting large datasets
- Data licensing
- Data visualisation
- Data models to predict future outcomes or understand what is happening in real time
- Artificial Intelligence

Responses to the ESRC's 2017 Skills Review highlighted similar skills gaps around advanced quantitative methods and data science, which included geospatial data (https://esrc.ukri.org/news-events-and-publications/news/news-items/knowledge-and-skills-needs-call-for-evidence-summary-report-and-next-steps/).

Prior to this the UKRI's Research Careers Network (which includes the Heads of Careers and Training, or equivalents, from across UKRI), identified data driven research and its applications as being a skills gap that cuts across all UKRI communities, this included 'systems approaches, research software engineering, visualisation, statistical approaches, risk and uncertainty, modelling, prediction and machine learning. As well as the need to develop quantitative skills to ensure that 'big data' is fully utilised across disciplines'.

We anticipate that many of these skills gaps are shared by businesses who are using geospatial data to develop new products and services. Addressing these skills gaps is vital to ensure a pipeline of high quality geo-spatial data from the publically-funded research base and its application into business services and products.

How can skills gaps be addressed?

In order to nurture highly skilled people capable of generating innovation and growth, UKRI invests in a variety of training including PhD and postgraduate training, short courses, and placements between academica and non-academic sectors. By working with universities and employers we equip graduates with skills needed to evaluate and use evidence and data across business and government sectors. These existing mechanisms for training can be strategically targeted to address specific skills gaps identified by UKRI, our partners in policy and business and are an established route through which skill development in the geospatial area could be developed.

Specifically NERC has started to address data related skills gaps, in environmental sciences though Centres for Doctoral Training (CDTs) in Data, Risk and Environmental Analytical Methods (DREAM), which is co-funded with

ESRC and Quantitative and Modelling Skills in Ecology and Evolution (QMEE). In addition, in its second round of Doctoral Training Partnerships (DTP2) NERC made the provision of 'Access for all students to appropriate data skills training' a requirement.

ESRC has invested in advanced quantitative methods, including geospatial data collection and analysis, via Q-STEP (http://www.nuffieldfoundation.org/q-step), an interdisciplinary Centre for Doctoral Training (https://datacdt.org/) and through incentivising the development of training in advanced quantitative methods and data skills through our Doctoral Training Partnerships. In addition broader training provision is offered via the National Centre for Research Methods (https://www.ncrm.ac.uk/training/).

Innovate UK has provided a long-standing solution, in partnership with the rest of UKRI, for business-led skill needs in the form of Knowledge Transfer Partnerships (KTP). This programme provides an immediate bridge between the research base and industry to transfer new or innovative skills into industry. This is a flexible tool and applicable to any number of geospatial skill gaps.

The UKRI are also investing in CDTs that focus on areas relevant to Artificial Intelligence. A call for applications closed in July 2018 and announcements of successful applicants will be made in due course. See: https://epsrc.ukri.org/funding/calls/aicdts2018full/ for information.

The research and innovation network within the UK also draws upon their expertise and provides specialist skills training where relevant. For example: the University of Reading's Institute for Environmental Analytics creates and delivers targeted training courses to address market opportunities and the shortage of environmental analytics skills, giving companies, organisations and individuals the practical knowledge and confidence to make commercial use of the huge resource of open data. https://www.the-iea.org/services/training-development/; and the European Institute of Innovation and Technology (EIT) Climate Knowledge and Innovation Community (Climate KIC) has developed a range of online learning, professional development and graduate school programmes to build awareness and knowledge around acting on climate change https://www.climate-kic.org/programmes/education/

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Data discoverability: One of the main barriers to being able to reuse data from research is knowing what is available, gaining access to the data and

understanding whether it can be repurposed or developed into other commercial or non-commercial applications of value to businesses and society (see: https://blog.wellcome.ac.uk/2014/08/20/the-discoverability-challenge-how-can-we-make-research-data-easier-to-find-and-use/).

UKRI is committed to opening up research data for scrutiny and re-use and support the principles in the Concordat on Open Research data that recognises that research data should be made open where possible.

NERC funds a series of Environmental Data Centres to ensure long term curation and reuse of valuable data sets. The challenge is making this vast volume of data available in useable formats (NERC data holdings equate to 10-12 petabytes, this is however doubling every 2.5 years). In the past the data centres have primarily served the academic community but NERC has recognised the value of the data and has an ambition, through a data Innovation programme, to link the environmental data holdings (and expertise) to other non-NERC, non-environmental data sets, to enable more effective response to the demands of a range of users. The programme will address other issues around data, such as barriers to accessibility due to the lack of analytical tools for non experts and secure space to analyse and integrate, often large datasets from disparate sources.

In addition to those mentioned above there are non-data-related barriers to accessing and using data such as Intellectual Property Rights or licencing-related issues, including both legal and cost barriers

Facilities for using secure data: UKRI (NERC) is aware of a number of recent examples of academics not being able to access private sector geo-spatial data (e.g. infrastructure location and condition, insurance loss data), however there is an understanding that, on the most part, there are sound regulatory, security or commercial reasons. A role for the geospatial commission could be to invest in secure platforms which would enable secure data storage that would enable access for appropriate research purposes, providing facilities to combine data sets (from non-secure sources) and with access to appropriate computing power. For example, the ESRC funded Consumer Data Research Centre: https://www.cdrc.ac.uk/, Data & Analytics Facility for Infrastructure: https://www.itrc.org.uk/dafni-data-and-analytics-facility-for-national-infrastructure/

UKRI also provides access to a wide array of Satellite derived imagery through the STFC JASMIN facility for research use and the Innovate UK Satellite applications Catapult CEMS and data visualisation facilities for commercial users.

Implementation of quality assured standards
The Geospatial Commission should consider the adoption of quality assurance standards and certification schemes to support the widespread and mainstream transfer of scientific data sets for commercial applications. Much work has been done in terrestrial environmental services to understand the traceability and uncertainty indication of environmental measurements (such as the MCERTS

certification scheme (https://www.gov.uk/government/collections/monitoring-emissions-to-air-land-and-water-mcerts), supported by ISO17025 with additional requirements for operator training) to support pollution monitoring, Kyoto/inventory reporting, water/soil/land monitoring and emissions from large combustion plants. This is to a point where the data service is legally defensible and can guarantee its quality. It would be very good to see Earth Observation (EO) and geospatial data reach this level of maturity as it is much more likely that existing service providers could integrate EO and geospatial data into existing services and provide an opportunity for growth and increase market share. This does not assume that EO/geospatial data is of poor quality, but that an accepted standard/certification scheme to simply indicate the level of quality of the data product should help enable its widespread adoption in governmental and commercial services. The barriers to this are that a top down approach is required to intervene in the industry, and there is a perception that certification brings additional expense (but actually results in improved customer value, customer relationship and revenue), however the Geospatial Commission could be well placed to lead on such an activity.

The proposed Industrial Strategy Challenge Fund (ISCF) for Satellite Data Revolution is explicitly designed to adopt, develop and promote standards for satellite derived earth observation data. The Geospatial Commission is already engaged in this process, and the ISCF will simplify both the technical and commercial environment for integration of satellite derived geospatial data.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Yes, UK mapping data has been at the forefront of digital integration but less so in the integration of the wider national mapping system. This is most visible in the prolific use of postcodes for navigation purposes, which can be ineffective. A variety of bespoke commercial solutions has been developed, predominantly in the satellite navigation device domain and associated smart phone apps. Other publically searchable databases are also using the postcode as a convenient identifier.

To properly support emerging technologies, an interface will be needed. Whilst a digital technical solution makes sense novel new solutions such as what3words have made significant progress in addressing the challenge in a straighforward way.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

UKRI would welcome working in partnership with the Geospatial Commission to continue to develop UK capability in Earth Observation (EO) data.

There is already vast capability and expertise within the UK scientific community. NERC's National Centre for Earth Observation (NCEO) provides world class capability and core expertise in Earth Observation Science, data sets, merging data and model evaluation. NCEO links this expertise in environmental science with progress in the satellite technology sector and supports the exploitation of satellite data for societal and economic benefit.

Sentinel data access to the academic community is provided via CEDA (Centre for Environmental Data Analysis) hosted on the JASMIN data/computing infrastructure, NERC-funded facilities in STFC.

Note that Earth Observation data is not only 'images' – the data can be quite complex, and require sophisticated processing algorithms to convert into 'usable' information (eg from radiance spectra to ozone maps). This requires appropriate (scientific) expertise, but also data storage and computation resources.

In the recently published Value of satellite-derived Earth Observation capabilities to the UK Government today and by 2020 – July 2018 report commissioned by Innovate UK on behalf of UKRI, London Economics highlights the opportunities and challenges within government in adopting satellite derived data within the context of existing geospatial challenges. The Geospatial Commission can play a critical, coordinating role in delivering on the report's recommendations, by consolidating requirements and points of engagement with industry for EO and other geospatial data sets, and ensuring EO practitioners across government, research and academia can help government to become an increasingly well informed and proactive customer, building on the UK GEOS concept.

Unleashing the potential of vast amounts of knowledge and data from satellite Earth Observation and remote sensing into commercially viable geospatial services is also something trying to be addressed within the recent 'Space Data Revolution' ISCF Wave 3 submission. This programme aims to create a commercial marketplace for EO data, combining with AI to support useful information services across Energy, Transport, Finance and Construction sectors through collaborative R&D resulting in new platforms, services and technologies. Should the SDR programme be successful this should also be considered as an important aspect of academia and industry collaboration to support the geospatial commission in their strategic objectives. The programme being led jointly by STFC, NERC and I-UK.

As the ISCF bid sets out, the UK requires the underpinning infrastructure to enable quick and easy access to interoperable and analysis-ready data to assist both the exploitation of EO data and application innovation.

In alignment with the ISCF, the Geospatial Commission could consider working with funding entities such as Innovate UK, UKSA and ESA to drive more strategic

funding into the application of EO and AI. This could enable large scale, higher value developments with export potential.

It should be noted that there are concerns within the research community around access to EO data, following the UK's departure from the EU (see the following headlines as examples: https://www.pixalytics.com/new_uk-eo-sats-brexit/ and https://geoconomy.com/index.php/2018/03/25/uk-faces-brexit-threat-to-copernicus-participation/. It is likely that the UK Government may look at how this could be 'mitigated' and the Geospatial Commission, working with others could have a role in this.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

From working with business users there are some general themes, that are relevant but not necessarily specific to geospatial data, which often get raised with regards to their requirements for data:

- Data usability [getting the underlying basics right] – removing to use (data-related or otherwise)
- Data interoperability
- Digital Environment
- The need to be able to access good quality data from multiple sources and use AI to help deal with the large volumes of data available. Also using AI to help reduce R&D timescales, therefore getting from data to market much quicker (and whether it was possible to collectively develop common AI tools that could be used by all).
- Skills and the retention of skills around AI and the use of Earth Observation data, especially with regards to training up the next generation of graduates who would then go to work in industry.
- Use of Intermediate software (this is dependent on the end-user and their level of expertise)

In addition to technologies required to provide new opportunities to process and exploit geospatial data for economic growth, there is reliance in some industries on models and provision of good quality, reliable Geospatial data to incorporate into physical models (e.g. flood models, air quality models, thermal models of buildings, oil spill models). From these models specialist products and services are developed. The UK engineering and environmental consultants are world-leading in this, for example, https://www.ambientalrisk.com, http://www.aether-uk.com/, https://www.jbaconsulting.com.

Developing technologies related to personal monitoring of for example air quality, will enable the public to monitor their environment with regards to human health. Linking such data with geospatial data (both indoor and outdoor) are likely to align with the activities in exposure and disease within the MRC-Public Health England

Centre for Environment and Health.

In recent years the research councils and Innovate UK (now UKRI) have been working together on a number of collective funds, for example the Industrial Strategy Challenge Fund (ISCF, now in its 3rd wave) and more recently the Strategic Priorities Fund (SPF), for which announcement of Wave 1 projects has recently been made (see: https://www.ukri.org/news/uk-research-and-innovation-launches-major-programmes-to-tackle-climate-change-and-drive-clean-growth/. Some of which include the development of new technologies and computing techniques that are relevant to Geospatial data.

The ISCF brings together research and business to develop, demonstrate and support the adoption of new products and services. Research is based around four grand challenges, AI and data economy; Ageing Society; Clean Growth; and Future of Mobility. The "Transforming Food Production" ISCF call, which is currently open to applications, is likely to use elements of geospatial data. Successful projects will aim to 'improve productivity and sustainability by developing enhanced decisions support, precision agriculture technology solutions and systems for crop and ruminant agriculture.'[1] In addition, a proposal for 'Space Data Revolution', jointly led by STFC, NERC and I-UK has been submitted under the AI and data pillar, in Wave 3 of the ISCF (see Q6 response).

The Strategic Priorities Fund is a new collective fund across UK Research and Innovation, which aims to better enable investment in cross-departmental research and innovation priorities across UKRI, thus increasing high quality multi-disciplinary and inter-disciplinary research and innovation (MIDRI) and positioning UKRI to be able to respond to strategic priorities and opportunities. Programmes funded under the SPF include "Constructing a Digital Environment" lead by NERC and supported by EPSRC (and Defra).

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Many forms of geospatial data will rely on the application of Artificial Intelligence (AI) to roll-out at a cost that will make the associated offering commercially viable. The application of AI to innovative, value adding geospatial solutions will in many cases be key to international roll-outs. This is particularly true for the application of satellite derived earth observation data which has the inherent potential for scale, globally.

[1] https://bbsrc.ukri.org/funding/filter/2018-iscf-challenge-platforms/

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

From a NERC perspective, NERC will fund the maintenance of data generated from the environmental science that it funds, if it is deemed that the data set has long-term value. This does however come at a price and NERC invests more than £5.5M annually in its Environmental Data Centres. [*Please note that this figure is for the ingestion, management and dissemination of data ONLY, it does not include the cost of hardware, associated infrastructure costs nor energy consumption].*

UKRI are developing a UKRI Infrastructure roadmap, under which data assets are seen as a vital part of the UK infrastructure landscape.

To enable public sector organisations to continue to invest in maintaining and enhancing our geospatial data assets, the necessary levels of funding are required. Data held by the organisations within UKRI, is generally held for research purposes, however much of it is open for wider use. UKRI does not generally curate data as a service for commercial users or government more widely unless additional funding is provided. Considering this options for continued investment could include:

1. The maintenance and enhancing of Geospatial data assets are publicly funded and data is freely available to all on OGL. Funding above and beyond what public organisations currently do would need to be provided from Central Government.
2. Data is available for research and commercial R&D, under a no-fee commercial development licence, but any commercially released service would return royalties (or an equivalent) to the data providers, which would be reinvested in the maintenance and enhancement of the geospatial assets.
3. As 2, but any data used in a commercial service or product would require a commercial (paid for) licence, the funding for which would be invested in the maintenance and enhancement of the geospatial assets.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Access to geospatial data is two-fold, firstly in the integration of data and secondly in its implementation “in the field”. The past decade has seen a transformation in the adoption of satellite navigation technology (or GNSS, Global Navigation Satellite Systems) at all levels of society. Predominantly this in the use of GPS but more recently the use of Galileo and EGNOS, provided by the European

Commission. Leaving the EU will limit some access to this infrastructure and the Geospatial Commission should provide a voice for the whole of the geospatial user community regarding alternative solutions, including inputting to the proposed UK GNSS solution but also alternate technologies as they reach maturity for adoption. This may include quantum technology solutions in the future but more immediate solutions exist in a variety of electronic navigation means, standard and quality control will be critical to successful adoption.

There are also civil vulnerabilities because of dependency on GNSS. These have been highlighted in a number of technical and economic studies, best encompassed by the blackett review of "Satellite-derived time and position: a study of critical dependencies" https://www.gov.uk/government/publications/satellite-derived-time-and-position-blackett-review

Expansion of monitoring networks – 'blowing up networks' for acute events (for example, flooding, air quality) through the use of cross-linked/combined networks, or the inclusion of citizen-science data (for example from wearable electronics, which could be used to monitor exposures related to human health). The terrestrial data could be used to validate/calibrate remote sensing data, or to support operational activities from delivery bodies.

Farm platforms — As underpinning infrastructure, BBSRC funds the North Wyke farm platform, which provides researchers from different communities and disciplines with access to a range of cutting-edge instrumentation.[2] The aim is to address key issues in sustainable agriculture, and data collected from the platform are publicly available.[3]

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Generic underpinning infrastructure required to build fundamental national capability would ideally be funded by both the public sector and wider industry. The nature of the development should be shaped by relevant UK industry members. The ISCF Space Data Revolution sets out a case for this and the learning within this could be expanded to all areas of Geospatial applications.

Public-private partneships should be encouraged where there are mutual benefits to be gained. For example, the Global Earthquake Model (https://www.globalquakemodel.org/) is an excellent example of a public and private sector partnership which uses geo-spatial data to develop a global model of earthquake risk. GEM has sourced data from around the world, developed data and inter-operablity standards and offers data layers and model components

[2] http://resources.rothamsted.ac.uk/farmplatform
[3] https://nwfp.rothamsted.ac.uk/

openly to users from insurance industry to the UN.

Agrimetrics (one of four Agri-Tech Centres) uses big data to increase efficiency and sustainability in farming[4]. Founded by Rothamsted Research, the University of Reading, NIAB and Scotland's Rural College, partners include Syngenta and DEFRA. Agrimetrics have used data on varieties, solar radiation and canopy development to create a Potato Yield Model app, which is used by Asda's growers to manage yields.[5]

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

The 2018 report "Value of satellite-derived Earth Observation capabilities to the UK Government today and by 2020 – July 2018" detailed under Question 6 includes a number of case studies highlighting the barriers to adoption, some of which will be mitigated by a common federated approach.

To extract the value of geospatial data which lies in academia, there needs to be greater interaction between academia and those within business who can develop products and services. In order to do this:

- New structures/initiatives are required to address data discoverability issue and raise awareness of what data is available in academia. These must connect geospatial data producers with policy and business problem holders (for which geospatial data could help) with solution developers who will apply geospatial data in innovative ways.
- Collaborative R&D programmes are needed to support businesses as they test application and use of geospatial data for novel business applications, de-risking the development of new products.

NERC are aware that even within the domains of environmental science, data is often siloed. NERC is working with its data centres on and Environmental Data Service, which will increase integration across its data centres so that information from across the environmental domains can be more readily found, accessed and used. It is NERC's ambition to improve and encourage the use of environmental data by external stakeholders (including businesses), and as part of this enabling/facilitating integration with environmental data from other data providers. This is a focus of its developing data innovation programme, Dodona.

Interoperability of geospatial data

[4] https://agrimetrics.co.uk/home

[5] https://agrimetrics.co.uk/case-study/agrimetrics-brings-potato-yield-model-to-farmers-fingertips

The Global Earthquake Model provides one example of data standard and interoperability.

Addressing the 'quality gap' in Earth Observation (EO) data for commercial environmental services is an important aspect for the geospatial commission to consider in its increase uptake of EO data and its widespread integration with other forms of data to deliver customer value. This is because the use of EO Environmental data may fall short in terms of the level of legality, trust and certification normally required from terrestrial based services to deliver environmental services in a number of sectors including renewable energy, combustion plant monitoring, ambient air monitoring, soil/land remediation, Kyoto/carbon inventory reporting. The adoption and implementation of a certification scheme for EO data in commercial services requires a top down approach, since individual parties from both research and industry communities will not adopt a new standard if it is not widely recognised. Many of these elements have been considered within the scope of The ISCF Space Data Revolution champions the concept of data standardisation and interoperability. There is critical opportunity for the Geospatial Commission to support initiatives to harmonise data standards across and within data types within this proposal and expand the learning to all areas of digital data collection.

A good model created and adopted in the UK environmental services sector was MCERTS, which created an industry accepted standard for certification of data, instrumentation and the trained operators following the international ISO17025 standard. This had the effect of driving a quality driven industry where all environmental information is quality guaranteed, auditable and will stand up to legal interrogation. MCERTS also had other benefits including the recognition of the skilled work of the trained operators with career development opportunities, an improved commercial marketplace for customers, and a general professionalisation of what was a scientific endeavour, into a commercial industry.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission could work to connect geospatial data producers with policy and business problem holders (for which geospatial data could help) with solution developers who will apply geospatial data in innovative ways.

In doing so they could support demonstrators and provide case studies showing the breadth of applications of geospatial data.

As a customer, the Geospatial Commission could identify and consolidate requirements and standards across government and act as a point of engagement with industry. This is needed not just for procurement as such but for ongoing engagement during the R&D to operational phase in order to ensure

developments are being steered to meet requirements. There is a significant secondary value in repurposing of purchased data. At present the same commercial data can conceivably be purchased multiple times for different applications.

Greater use of existing funding instruments such as the Small Business Research Initiative (SBRI) are also recommended.

More strategic funding could enable higher value developments that would not only benefit the UK economy but could pave the way for larger international contracts.

In terms of procurement, the Geospatial Commission could enable shorter cycles in procurement processes by the use of approved suppliers, similar in concept to g-cloud, to bring about faster transactions.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Significant public sector geospatial data holdings are available but not currently part of the Geospatial Commission. This includes data generated by publically owned or funded research institutes, such as the Natural Environment Research Council's:

- Centre for Ecology & Hydrology (CEH)
- National Oceanography Centre (NOC)
- National Centre for Atmospheric Science (NCAS)
- National Centre for Earth Observation (NCEO)
- British Antarctic Survey (BAS)

NERC has a network of environmental data centres that provide a focal point for NERC's scientific data and information. These centres hold data from environmental scientists working in the UK and around the world. The data centres are responsible for maintaining environmental data and making them available to all users, not just NERC researchers but others from science, business and government.

It is essential that data generated through NERC supported activities are properly managed to ensure their long-term availability. The data centres are experts in the collection of scientific information, state-of-the-art data management and preservation techniques, resulting in a high quality and important national asset available to all.

The range of data held within the data centres is vast, covering all aspects of environmental science.

- British Oceanographic Data Centre (Marine)
- Centre for Environmental Data Analysis (Atmospheric and Earth observation Data, and the UK Solar System Data Centre (Solar and space physics))
- Environmental Information Data Centre (Terrestrial and freshwater)
- National Geoscience Data Centre (Geoscience)
- Polar Data Centre (Polar and cryosphere)

For example,

- UK Landcover map providing detailed coverage of vegetation and habitat types: https://www.ceh.ac.uk/services/land-cover-map-2015
- UK Lakes data is a GIS-based inventory of lakes, including typology, chemistry, biology; https://eip.ceh.ac.uk/apps/lakes/
- National River flow Archive: https://nrfa.ceh.ac.uk/
- General Bathymetric Chart of the Oceans (GEBCO) which aims to provide the most authoritative, publicly-available bathymetry data sets for the world's ocean: https://www.gebco.net/

Aside from these data centres, important assets exist in higher education institutions. For example, Cranfield University hosts the National Soil Resources Institute.[6] The Institute has produced a National Soil Map which is usable by non-soil scientists and provides evidence to enhance decision making (for example in deciding where best to grow particular crops).[7]

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

The single UK Strategy should provide the UK's overall direction and strategic goals for geospatial data and information (and its use / reuse). It should acknowledge where there are synergies and cross overs across the UK and where there are regional differences. Each DA can then align their own strategies to this, giving them the freedom to shape their strategies to accommodate the regional differences, but ensuring that they are aligned around the "commonalities" across the UK.

The Geospatial Commission could play a coordination function providing communication and information across the strategies.

6 https://www.cranfield.ac.uk/centres/soil-and-agrifood-institute/research-groups/national-soil-resources-institute

7 https://www.cranfield.ac.uk/case-studies/research-case-studies/national-soil-map

The Geospatial Commission also has the opportunity to bring about wider coordination and greater utilisation of particular practioners from across government, research and academia at a regional and national level. This could enable proactive, highly informed and coherent strategy development.

This type of coordination could also provide a much-needed unified point of engagement with industry, which could in turn, help inform the strategy. Maintaining a flexible approach in a common strategy also opens the opportunity for international collaboration and exports. Geospatial data may define borders but is not bound by them. Setting or adopting appropriate standards that can be applied internationally is critical for internal collaboration and UK exports and should not be limited to regional variations.

AS mentioned in Q.9 UKRI are developing a UKRI Infrastructure roadmap, under which data assets are seen as a vital part of the UK infrastructure landscape.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The creation of a geospatial forum, building on the UK Government Earth Observation Service (GEOS) concept, could enable the sharing of best practice of location data use among local authorities. This could be conducted virtually through the use of a portal and physically at an occasional conference. Demonstration is key element of coordination and adoption and whilst individual schemes exist these should be coordinated and consolidated where possible and delivered at scale to promote adoption.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

With regards to Infrastructure and Construction, Biodiversity Net Gain (BNG) could become an obligatory part of the National Planning Framework for new developments and infrastructure (over a certain size). Geospatial data would be invaluable in planning/implementing BNG to ensure a connected landscape for wildlife along 'green corridors'. Ref:
https://www.nipa-uk.org/uploads/news/WSPPB_Biodiversity_whitepaper_Copy.pdf
https://www.gov.uk/government/news/hs2-launches-plans-for-unprecedented-green-corridor-stretching-alongside-the-railway

Scale-up of geospatial data is the subject of an ISCF wave 3 bid – Space Data revolution, where such data, linked to more powerful data analytics (such as through AI), can provide greater business opportunities and economic value in numerous business sectors including transport, energy, finance and construction. As mentioned above (question 7), geospatial data will also play a part in the "Transforming Food Production" bid to increase crop and farmed animal productivity.

On natural resources, two areas of precision agriculture are especially noteworthy: precision steering and precision agronomics. There is significant growth potential in precision steering (where GPS guidance is currently used to auto-steer tractors) because GPS data is also crucial for robotic and autonomous systems in agriculture more broadly. Such developments in technology are a significant driver of growth in the global market for agricultural machinery, which has been estimated to be worth $243 billion by 2025.[8]

Precision agronomics aims to provide farmers with evidence that allows them to manage farmed species to improve yields and productivity. Since geospatial data is used to bridge the gap between the biology of individual organisms and the surrounding ecology, research in precision agronomics sits at the interface between NERC and BBSRC. Through the Sustainable Agriculture Research and Innovation Club (SARIC)[9], NERC and BBSRC have worked together to support the development of farmer decision support tools that use geospatial data. www.soilquality.co.uk combines geospatial data with geochemical datasets and biology to provide evidence for managing soil to maximise yields and minimise the presence of soil-borne pests and diseases.Other areas include the improved monitoring of crop production and modelling of crop performance. For example, the High Value Crop Monitoring (HiVaCroM) project is funded by the European Space Agency and is focused on delivering improved forecasting of potato yields through the use of satellite data , while Climate Corp, which was acquired by Monsanto in 2013 for $930M, focuses on combining data gathered on farm with landscape datasets to provide evidence for current crop health and growing strategies, such as soil management and pesticide usage.

[8] https://www.grandviewresearch.com/press-release/agriculture-farm-equipment-machinery-market
[9] https://bbsrc.ukri.org/innovation/sharing-challenges/saric/

Geospatial data is being increasingly used to monitor global forests e.g. Forests 2020, funded under the UKSA International Partnership Programme. This is aimed at addressing inadequate monitoring systems which, despite frameworks to help developing countries protect and restore their forest resources, remain a barrier to effective implementation. ESA's seventh Explorer Mission BIOMASS due for launch in 2020 has been developed by a consortia led by Shaun Quegan, Professor of Mathematics at the University of Sheffield to accurately measure how much wood is growing on Earth. Particularly important will be the ability to track forest degradation and measure the currently unmeasurable movement of carbon and other green house gasses.

As individuals, communities and a country, we are required to make multiple decisions using UK and global landscapes. A landscape is the product of environmental processes, social and cultural requirements and values, and ecosystem services associated with them. It will change continually across multiple scales (of space and time) through changes to natural systems such as water, air, climate, and biodiversity, which are themselves influenced by multiple uses and users of the landscape. All have been changing over time and interact; many are now moving faster than ever before. To understand the impacts of our use of the land on the wider environment, and to improve the sustainability of land management (including agriculture), we need interdisciplinary systems-based approaches at multiple scales (from field to farm and landscape).[10] The increased resolution (spatial and temporal) of geospatial data and the increased diversity of the type of data available will allow 'better', or more informed, decision making, but only if we are able to take new approaches that will resolve the complexity of processes and trade-offs between multiple objectives.

In addition to geospatial applications which could be scaled-up or developed in order to capture economic value, there are opportunities to link up and use remote sensing with geospatial data in the context of urban and health monitoring.

Satellite derived earth observation data is one type of geospatial data that inherently lends itself to being scaled through its application. With the advent of low cost, small satellites circuiting the earth at low earth orbit (LEO) altitudes, ongoing advancements in data quality and increasing data frequency, this type of data is becoming more valuable to a range of applications. The emerging application of AI is now the key to unlocking the potential for scale, at a viable cost, and is pointing the way to a much greater uptake of earth observation data, at scale, in the near future.

There are various projections for the value of the satellite derived earth observation market. One estimate projects the global market to be $66Bn by 2020 (GeoBuiz 2018).

[10] Achieving Sustainable Agricultural Systems (ASSIST) is a long-term National Capability programme jointly funded by NERC and BBSRC which aims to work with the farming industry to increase productivity without causing environmental damage.

Q18: Are there any other areas that we should look at as a priority?

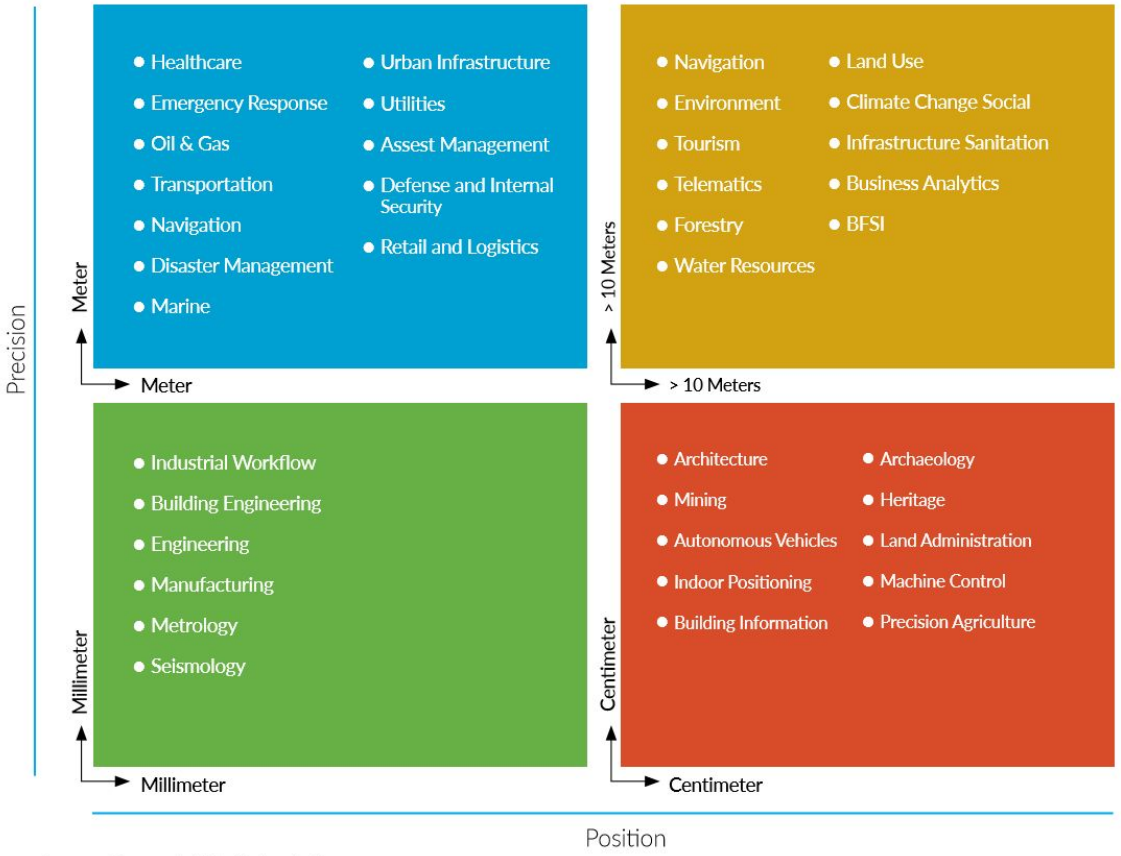
There is potential to expand on natural resources to include for example the Oil and Gas sector using geospatial data on exploration and monitoring. This could include the use of computational techniques and analytical methods, including AI or edge computing. There is a high level of adoption in this industry already and integration should not be onerous.

Green finance – and green growth – offers unprecedented opportunities for financial institutions to invest in the restoration of UK natural features such as woodland, peatland and wetland. The UK Government's **Green Finance Task Force** in March 2018 that "*increased private sector investment into protecting and enhancing natural capital will also be crucial to improving our resilience*."
Geo-spatial data has a key role in identifying, monitoring and verifying natural assets, in a similar way as it is used for REDD (e.g. https://www.planet.com/markets/redd/) .

Access to robust geospatial data is also central to managing growing climate and environmental risks through improved analytics. The demand for such a capability is increasing to reflect not only the growing exposure of public and private institutions to the physical risks associated with climate change and its impact on the probability of natural catastrophes, but also the risks associated with the transition to a low carbon economy and the associated implications for firms and investors exposed to corresponding volatility in asset values (the so-called 'stranded assets' problem identified by the Bank of England and others). At the same time, regulatory policy is increasingly requiring that firms and financial institutions make their exposure to such risks transparent so that they can be reflected in investment decisions and capital allocated efficiently (see G20 FSB Task Force for Climate- Related Financial Disclosures ("TCFD")). This in turn cannot be delivered without improved analytics and access to the data required to support this, including robust geospatial data. [This potential deficiency is the subject of a proposed ISCF Wave 3 challenge].

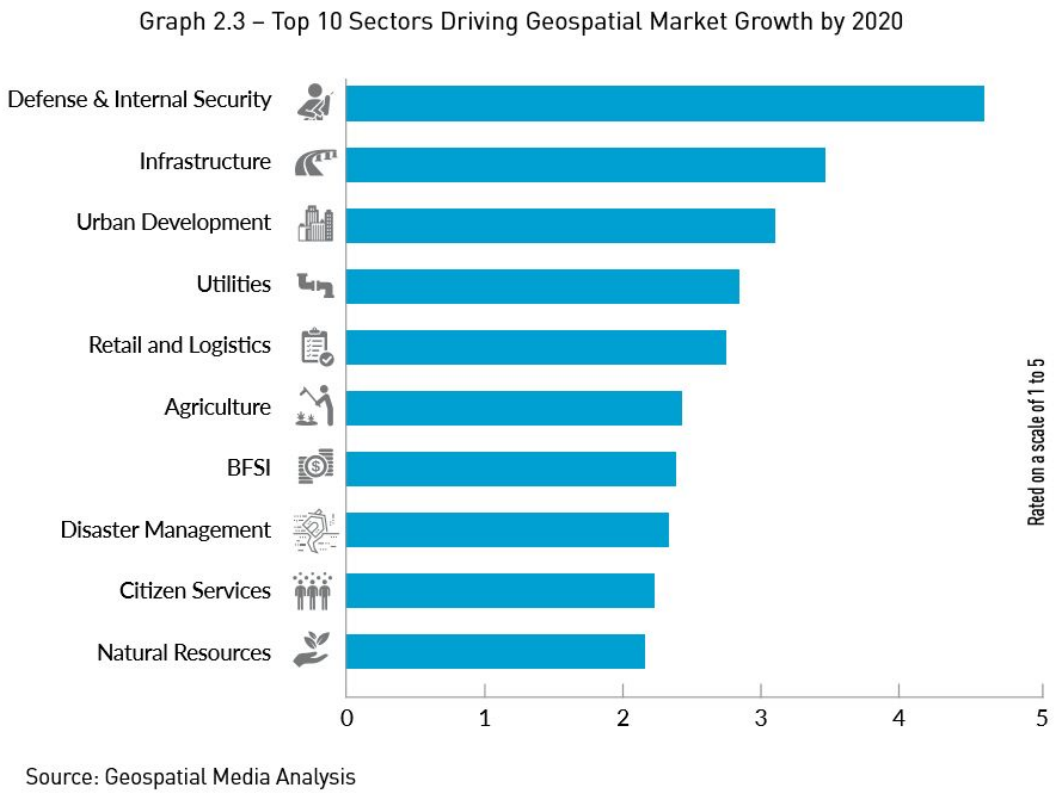
An increasing number and range of sectors are leveraging geospatial information to improve efficiency and productivity. The Geospatial Industry Outlook and Readiness report 2018 confirms that the geospatial industry is witnessing demand growth from "more and more sectors that are integrating geospatial solutions into their daily workflow management" and the automation of such.

Figure 2.2 – Geospatial Industry Applications: Position to Precision



Source: Geospatial Media Analysis

The report goes on to suggest that the top ten sectors driving near-term geospatial market growth are as follows. These include some of the high value sectors already identified by the Geospatial Commission.



A recent economic study to determine the value of satellite derived earth observation capabilities to UK government (by London Economics) identified new near-term potential in transport, (and particularly infrastructure monitoring), forestry, the built environment and coastal management and further applications in agriculture, maritime and flood management (as referenced in Question 6)

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Turning the question around, many forms of geospatial data will rely on the application of AI to roll-out at a cost that will make the associated offering commercially viable.

To date we have seen a transformation in internet search capabilities to include location relevance. This impact of this is visible in retail, services and navigation or mapping but is increasingly relevant to all areas of interest. Increasingly this is being linked to identity and behaviour. An issue already seen in the telematics market. Regulation in relation to the significance of location as an identifier and how location based information is shared will require regular revision in our modern society with impacts across to wider geospatial data.

Trust and confidence in dynamic geospatial data i.e. that, which might be

changing continually, can be maintained through standards but for safety critical activity may require regulation.

The application of AI to innovative, value adding geospatial solutions will in many cases be key to international rollouts. This is particularly true for the application of satellite derived earth observation data which has the inherent potential for scale, globally.

Applying AI to earth observation data could unlock high value potential for applications in many sectors.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By leading the way in major commercial markets, internationally, the UK can become not only highly visible in the international geospatial world but can gain a competitive edge in a high growth, global market and thereby benefit economically.

This can be brought about by creating the right infrastructure, by stimulating and funding UK based innovation, encouraging and facilitating collaboration across and among academia, research and industry, and supporting scale-up and international trade from the UK. It can also be assisted, where relevant, by UK government becoming a lead or anchor customer.

Innovation support needs to be guided to particular technology developments and applications including AI to unlock the potential for scale, and to high value market areas.

Businesses then need to be supported if not incentivised to scale and address international markets, quickly. This could be enabled by applying and co-ordinating public sector funding to de-risk follow-on private investment.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Ultimately, from an economic perspective, it is private investment in innovation that will enable UK businesses to scale with any significance internationally. In this aspect, North America is a strong point of comparison. There are also interesting developments in Australia.
Many changes in the use and therefore demand for geospatial data come from commercial applications; which are not so specifically bound by national boundaries and may require specific horizon scanning and engagement.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UK Space Agency (UKSA)
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	**x**
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Yes

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- Ubiquitous Web and Geographic Information Systems
- Earth Observation Applications (User driven)
- Building Information Modelling (BIM)
- 3D GIS
- Web GIS Application Development and Common Libraries
- Web of geospatial data
- Geospatial Database
- Open data (what it means and its principles)
- Big data storage and analysis (high performance array database principles)
- Virtualisation and Cloud (theory and practice)
- Standards in Geospatial (OGC, IETF, etc)
- FOS4G (Free and Opensource Software 4 Geography, principles and practice)
- Spatial Data Infrastructure (SDI) Development for Enterprise Applications
- Scaling and Clustering
- User Centred Design
- Cartography
- Digital Earth
- Virtual Globes and Spatial-oriented Augmented Reality
- Location Based Services and Mobile GI Applications
- Model Web
- Geospatial Workflows and Service Composition
- Geosensors Networks and Sensor Web
- Spatial Data Infrastructures: Data and Service Sharing
- Future Internet, Linked and Open Data and the Semantic web
- Geospatial Analysis and Visualization
- Volunteered Geographic Information and Community Observatories
- Crowdsourcing
- Co-creation and Participatory GIS
- Data Mining and Knowledge Discovery
- Data Acquisition
- Modelling, and Analysis
- Uncertainty and Error Propagation
- 3D Modelling, Analysis and Visualization
- Data Security

Many of the skills listed above are in short supply in the UK geospatial industry. Only by targeting the technologies and skills above at a grassroots level will the UK avoid a growing skills shortage.

Driving skills in the UK (at a grassroots level) will require the development of a skills programme that will target secondary education and academia, not just to engage and promote the cross-cutting nature of skills required by the geospatial

sector but to provide the ability to influence and direct through leadership in the area.

Addressing skills coupled with delivery and customer focussed development, could see a step change in the UK use of satellite data. The UKSA and the Geospatial Commission should work together with other stakeholders to achieve this.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The UKSA itself is not an organisation that operationally delivers geospatial services, however it has an overarching understanding of satellite Earth observation, how this plays into the wider Geospatial community,the associated technologies and what others in the commercial, academic and public sector need to do to use the data.

Our Space for Smarter Government Programme (SSGP) already runs an “Introduction to Satellite Applications for the Public Sector (ISAPS)” course to raise awareness of the role that space data and services has in public sector delivery. The 1-day course is delivered free of charge to public sector attendees in order to raise awareness of the opportunities offered through space solutions to public sector problems. As well as raising general/basic awareness with policy professionals and senior leaders, SSGP engagement indicates that further training interventions would be beneficial, including the inclusion of targeted specialist space data and services for Government professional functions such as data science and geography. As well as a lack of understanding of the role Earth observation can have in public sector delivery, the risks and constraints of underpinning technologies in common use which are reliant on PNT (Position Navigation and Timing - such as GPS) in applications/services across the public sector are not well understood.

The Space Sector is predicted to expand by some 40,000 new roles by 2030, the majority of which will be in the management, use and manipulation of data, requiring a solid foundation in the skills and topics described above. In order to support the development of the pipeline from school, through university or vocational training into a career in the sector, best practice examples from other areas need to be utilised. For example, these include the provision of digital datasets for the A Level Geography curriculum, support for teacher training to deliver this, relevant role models on careers platforms and visiting schools and universities, provision of real-world challenges for undergraduate and masters projects, consideration of vocational training routes (possibly including Degree Apprenticeships), and provision of quality work experience and internships.

Bolstering education opportunities and outreach, expanding existing training on a

wider scale and the inclusion of specialist space data and services within mass training for professional functions within government would help address skills gaps. UKSA already has a role in the delivery of these approaches in relation to the space sector and would like to explore scaling these areas further with the Commission as there is potential to enable some “quick wins”.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Within the industry, generally, there has long been a challenge of access to geospatial data. Various initiatives both nationally and internationally have been introduced to improve the position. More specifically within the space sector, Earth observation data has long been the preserve of academic institutes, national government organisations or private industry and has therefore been challenging to access. With the advent of the European Commission Copernicus programme, access to data has improved but historically access to satellite derived data has always been something of an afterthought. For example, an organisation such as CEDA (Centre for Environmental Data Analysis) with funding constraints may not have been able to consider data access for commercial companies as a high priority.

The Sentinel Data Access Service (SEDAS) is a UK portal for accessing free Earth observation data from Copernicus. Initial funding was provided by the UK Space Agency to establish this capability and operate for 2 years. Funding to sustain and improve operation is based on commercial revenue generation via the Satellite Applications Catapult.

Analysis Ready Data (ARD) is the concept of processing Earth observation data to a set standard. Processing the data in this way for use across many user communities supports the uptake of Earth observation data by removing some of the associated overhead and specialist skills needed by each user. Copernicus data, specifically from Sentinels 1 and 2 already have developing standards for ARD products in other countries and the benefits are being widely felt. In the UK we don’t currently have a centralised system for the production of ARD and support for the adoption of standards could provide many benefits for government and the private sector by lowering the barrier to entry for innovators in Earth observation.

Maintaining access to Copernicus data forms part of the UK Space Agency EU exit mitigation planning. We would be keen to work with the Commission on this topic.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Having a consistent source of reference for addressing data in the UK is key to the development of downstream applications for the Earth observation and location based services industries. With the development of Address Base Plus a better source of data is available than ever before, however to see improvements at scale in the way the industry consumes the data, web services need to be made available to aid the fusion of satellite derived data and terrestrial address data.

Forming these connections between the satellite derived and terrestrial systems is essential for the benefits and impacts to be fully realised. Government intervention is required in some areas to ensure that “geospatial” truly means **all** data with geographic reference regardless of source. Satellite derived data is just another geospatial data set, but it has the ability to provide information at an incredible level of detail, over huge areas, repeatedly and consistently and at an ever-increasing frequency. The inclusion of satellite derived products should not be as a bespoke service unsuitable for increased scale but a staple of any project, programme or initiative that requires a level of monitoring, connectivity or location-based service.

The UKSA would be part of the solution but it will need a coordinated vision and commitment to an infrastructure over the medium term if the UK is to retain its world leading position in Earth observation data use. See Q6.

Q6: How should the commission be looking to develop the UK’s capability in Earth observation data, both technologically and to support an effective market?

The vision agreed by the UK Earth observation community is: "*The UK will be a world leading access point for global users, providing trusted, quality assured satellite derived products and delivering growth over the long term by maximising the exploitation of EO data and services by public, academic and private sector users, through a reliable, open, secure and sustainable capability.*"

The current scene in the UK with regards to Earth observation data is rapidly evolving. Due to the way the UK operates and/or funds its Earth observation capability, pockets of activity occur between publicly funded organisations such as UKSA, Innovate UK and RAL Space, not for profit organisations part funded by Government (such as the Satellite Applications Catapult) and industry (through major primes or the plethora of Small Medium Enterprises working in the downstream EO applications field).

There is a need for strong coordination between the organisations that run the national infrastructure of Earth observation data, and for investment and consolidation in effort. The UK has the capability to lead globally in the advancement of supporting and dissemination technologies such as storage and processing capability, Analysis Ready Data/Data Cubes, common architecture that is interoperable with systems across Europe and world-wide and trusted quality assured data (calibration and validation).

UKSA would welcome the opportunity to talk about any decisions which need to be made and the roles respective organisations play in order to best serve national interest and ensure effective prioritisation

In terms of developing the pull from government stakeholders and the enabling industry to meet those requirements, a lack of awareness/understanding of what Earth observation can do or be used for, an inability to articulate user requirements, a lack of understanding of the ongoing costs associated with current ways of working and the lack of appropriate routes to market are all potential blockers to be addressed.

The Agency's Space for Smarter Government Programme has been working to create a market for EO within Government, and although considered a successful programme, the level of funding and resources assigned (£1.5m pa) prevent it making the organisational and transformative changes that are required to be enabled across Government.

Currently there is no universal way of government to centrally procure commercial satellite data or services from industry, which can lead to either a compromised service, the end users' requirements not being met, or no service being procured. The commission should be looking at a cross government procurement methodology that enables the uptake of Earth observation data and services. A model like that adopted by the Digital Marketplace which has the flexibility to buy data, services and expertise and a combination of these, with agile pull through of applications from development programmes should be considered

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are many technologies that are influencing the direction of travel for the geospatial community and a lot of them focus on end user interaction rather than processing. However, a number such as:

Big Data analytics
Machine learning and AI
Data Cube technology (multi-dimensional array database structures for spatial temporal analysis)
Computer vision.
Distributed computing.
Linked data technologies and the web of data
Semantic web technologies
Sensor Web
IOT (internet of things)

provide foundation technologies that will enable the next generation of geospatial applications.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications are at the core of what we believe to be future technologies, from autonomous vehicles, to food production and energy generation, geospatial data will underpin the way in which we interact with the environment we live in. Due to the underpinning nature of the geography any acceleration in the development of geospatial technologies is only going to increase the rate at which other technologies can be developed and adopted.

Firstly, we need to consider how the data is stored and how it can be consumed. Infrequently updated data, that is prone to having multiple versions even within a single organisation and relies on the user downloading or receiving on physical media is not suitable for advanced applications or technologies as systems rely upon consistence to enable any sort of automation. From this we can conclude that geospatial data needs to be stored in a structured and accessible format and disseminated in line with appropriate standards through APIs to enable data to be connected or linked to other data. Next, we need to think about the interoperability of data and the ability to fuse and process data into a form that can be consumed by the intermediary or end user technology and potentially passed on to complete the awareness triangle of locate, sense and inform. All the above can be achieved but it relies upon the systems, standards and openness to enable it.

Exemplar industries that would benefit from enabling geospatial data and technologies are nuclear new build, the construction and future housing industry, and national infrastructure, all of which have programmes of technology roll out. The National Infrastructure Committee will also have many examples where geospatial and space technologies will enable development.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Investment in maintaining and enhancing geospatial data and assets is crucial and should be appropriately funded. More than that - it should be at the core of what government wants to achieve with a clear collective view about the scale of the government activity required and the role of government in this arena.

Geography and geospatial data have the ability to transform and enhance all public services whether it be satellite derived or terrestrial, and neither in isolation will have the impact of both together.

[Text redacted]

Previously the focus of funding bodies has been on demonstrating capability in the market. Innovation programmes need to focus on the service development and change management elements of adoption in order to embed these services longer term.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

The focus of this question is possibly more about " "What areas……. should we be prioritising the development of, **to enable geospatial data to meet the emerging requirements of the end user community**".

Underpinning geospatial infrastructure should focus on enabling the following suit of technologies.

Big Data analytics
Machine learning and AI
Data Cube technology (multi-dimensional array database structures for spatial temporal analysis)
Computer vision.
Distributed computing.
Linked data technologies and the web of data
Semantic web technologies
Sensor Web
IOT (internet of things)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The private sector does have a role in the development and maintenance of the underpinning infrastructure. Government investment in maintaining technical skills within the departments and developing new skills in technical and geospatial infrastructure could allow for greater impact by enabling industry to focus on innovation of the output from the infrastructure and delivery value through end user services rather than data management and maintenance.

As any infrastructure is developed the business model which surrounds that should be carefully assessed to ensure sustainability.

Where underpinning infrastructure could be interpreted as upstream such as satellites or positioning then private sector has a key role.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There can be challenges when accessing geospatial data from the public sector as there is a widely adopted set of standards (adaptations of OGC, Open Geospatial Consortium, standards) that are not universally implemented. Funding a minimum set of requirements would achieve a greater level of consistency

In addition, a lack of awareness of the role space plays in GIS causes resistance to uptake. Satellite derived data is generally thought of as exotic, difficult to work with or expensive, however satellite derived data underpins most geospatial technologies and data. Even within GIS departments it would be helpful to have a better understanding of geospatial data acquisition and Earth observation i.e. the different types of sensors and what they are capable of, their limitations and how the data is captured.

Our Space for Smarter Government Programme developed a new course to try and overcome this lack of awareness/barrier, which could be scaled for additional stakeholders across the public sector with suitable funding and resources.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

There are lots of programmes in government that could offer lessons learnt here.

The Space for Smarter Government Programme, having just completed a high-resolution procurement of Earth Observation data for R&D purposes for use across Government, has understood the challenges in being an effective customer and would be happy to share this experience with the Commission.

The Geospatial Commission can act as a more effective customer of geospatial data by:

- understanding the requirements of government when purchasing;
- ensuring a minimum set of skills is present in Government to ensure effective use of the data is achieved;
- developing and ensuring that an effective and efficient purchasing methodology exists that enables the market place to engage effectively with Government;
- ensuring that licencing requirements are appropriate for the use. If licensing is too prohibitive it will stifle the ability to innovate;
- purchasing certain key data sets and software tools centrally to ensure consistency across all of government and reduce any risk of duplicating spending.

Again, the potential impacts of UK losing access to some of the EU Copernicus programme data will also drive thinking in this area.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Historic climate records and readings from the Met Office.
Geological Maps from the BGS
Better access to data from CEDA (Centre for Environmental Data Analysis) and NODC (National Oceanographic Data Centre)
Land Parcel Information System (LPIS) data from the Rural Payments Agency
Communications networks such as Broadband and mobile telecoms.
Local Authority Data, such as planning and development, health care and services.
Healthcare data could support many applications to support efficient and effective healthcare.
UK Environmental Observation Framework Catalogue – this contains numerous environmental monitoring data sets - which are already available but could benefit from more promotion and centralised investment

As a proportion of the data above is dynamic, ensuring this data is released through continually live webservices would support novel applications.

Access to Copernicus data through live webservices and data processing infrastructure such as a data cube, would support new applications in the Geospatial Industry.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for regional variations?

Developing a single strategy across the Geospatial landscape is never going to be easy as the ecosystem is complex.

Firstly, there is need to identify what are the blockers to use, and therefore growth, and what are the enablers. Once opportunities are identified, a set of principles needs to be drawn up. The diverse nature of the industry and the users means it is easier to adopt a set of principles across multiple strategies rather than stipulating a suit of technology or standards. This approach also allows for regional variations.

Identifying the blockers that - with some effort - can generate enablers, breaks the strategy down into bite sized chunks. For example, skills, procurement, and lack of consolidated infrastructure are three areas that can be addressed, and a programme of work to improve these elements could be planned in achievable and timebound objectives.

There is also a need to fully understand the landscape of geospatial within the UK. There are a lot of stovepipe activities in the UK and several organisations that provide R&D funding and innovation centres (such as the Geovation Hub and Catapults).

Any strategy that is developed would need to consider the development of the professions in Government (policy, geography, data science) and skills development such as the Centre for Doctoral Training in Geospatial that has been proposed by Newcastle and Nottingham universities and other initiatives such as NCEO (National Centre for Earth Observation).

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

It may be appropriate to fund key initiatives centrally and possibly consider mandating certain requirements if there is a clear case to do so.

SSGP has encountered common issues affecting multiple local authorities and there is no obvious route/mechanism for engaging centrally to scale these applications nationally in a way which enabled sustainable services to be developed.

The approach needs to be consistent nationally to unlock potential and achieve benefits. Identifying the data sets that will have the highest impact in terms of local authority effectiveness and industry impact, and then looking to fund those centrally should be considered.

The Space for Smarter Government Programme understands from the experience of the 100/1 project (which looked at generating affordable applications for local authorities) that for an application to be adopted, it needs to be affordable and for that to happen it must be designed for local authority use but rolled out at a scale of economy.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

In addition to the sectors above, the UKSA has been funding projects for several years through the:

Space for Smarter Government Programme (SSGP) - a programme that facilitates, investigates and demonstrates the use of satellite derived services in Government. It is currently working on themes associated with Disaster Risk Management, Emergency Services and Infrastructure.

International Partnership Programme (IPP) - a programme that funds (through Overseas Development Assistance funding) the development of satellite derived services to support developing countries.

ESA Advanced Research in Telecommunication Systems (ARTES) - ARTES, transforms R&D investment into successful commercial products and services by offering varying degrees of support to projects with different levels of operational and commercial maturity.

Each of these programmes has successfully demonstrated how satellite derived geospatial applications can provide benefit to the user and several of them fit into the priority areas identified by the Commission. A list of the applications with a brief description can be provided on request.

Other high value sectors would be:
BFSI (Banking, Financial Sector and Insurance) and healthcare.

Q18: Are there any other areas that we should look at as a priority?

As significant proportions of Local Council and national budgets are spent on Health and Social Care, significant benefits could be achieved by including this as a focus area. A competition to explore the role of satellite applications within the NHS is currently underway through the ESA Business Applications Programme.

Other high value sectors would be:
BFSI (Banking, Financial Sector and Insurance)

The UK Space Agency works closely with our industry and the space sector is well positioned to provide a market view. One approach to the public sector could be to look at the Governments top issues and risks and see whether there are additional roles for geospatial data which it isn't already meeting.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

UAVs
Autonomous vehicles
Space-Launch
Digital Twins
5G
High Speed Rail
Smart IoT devices and Ubiquitous Sensors.
High Altitude Platforms
Automated infrastructure.
BIM (Building Information Models)

Q20: How best can we make the UK's presence in the international geospatial world more visible?

By investing in skills and infrastructure that enables the UK to seriously engage on the international platform. There are many international bodies and we are members of many of them but there needs to be an investment that enables the UK to do more away from the meetings and groups but works towards the goals of the international teams.

This will bring influence and presence in the international geospatial world. For example, with:

Committee on Earth Observation Satellites (CEOS)
Group on Earth Observations (GEO)
European Space Agency (ESA) bodies
Open Data Cube Initiative (ODC)
Open Geospatial Consortium (OGC)

Through investments in programmes such as IPP (International Partnership

Programme) the UKSA has made significant steps towards engaging in the international Overseas Development Assistance (ODA) community, and this has opened opportunities to work with key international organisations such as Geoscience Australia. However, more work and investment is required to maintain these relationships and our influence.

The UK government needs to be bold, confident and invest in operational services. This is an area where the UK can step forward on the international stage as all countries struggle with it.

As an example, SSGP believe the UK nuclear industry could be an example where the UK Government could provide real visible leadership and mandate that all new build generation and disposal facilities monitoring by UK regulators will include satellite derived geospatial data in their future inspection regimes. This is a bold move and one which would stimulate further application development with the potential for export overseas.

The UK also has a significant role in Disaster Response, through government involvement in international organisations such as the International Charter: Space and Major Disasters and through charities, such as Map Action which is run from the UK and actively provides on-site emergency mapping for disasters globally.

In summary:

- The UK needs to have sustained engagement with the international forums that drive the development of technology, application and ultimately growth.
- The UK needs to double its efforts in developing sustainable, operationally services that exploit the great technical foundations the UK has developed in geospatial and other satellite derived services.
- Finally, the UK needs a coordinated effort to direct the export of opportunities developed through the previous points.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The US has a good history of development and adoption.

Singapore also rates high as an international exemplar as does Germany, the Netherlands, China, Canada, Denmark, Switzerland and France, with Australia and Poland rapidly improving capability.

The UK is in a strong position to remain a leader in the development of Geospatial capability, but this will only remain the case with sustained investment in space and the wider geospatial sector.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	UKspace Earth Observation Committee
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	**X (see below)**
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

This response is being submitted by the Earth Observation Committee (EOC) of UKspace, the trade association of the UK space industry

UKspace has a mission to promote the best commercial, political and public environment for the UK space industry. It includes in its membership companies from across the whole spectrum of space activities with large, small and start-up organisations represented.

The UKspace EOC includes representatives from the following UK organisations that are actively engaged in Earth Observation (EO) business:

- AB5 Consulting
- Airbus Defence & Space
- APC Technology Group
- Barum and Dewar
- CGI
- Cherry Space
- Deimos Space
- Earth-i
- Geomatic Ventures Ltd.
- Geoseren Ltd.
- GMV UK
- Goonhilly Earth Station
- InSpace Consulting
- JCR Systems
- National Physical Laboratory
- RHEA Group
- Satellite Applications Catapult
- SciSys
- Serco
- Space Connexions Ltd.
- Teledyne e2v
- Telespazio Vega UK
- Tessella
- Thales Alenia Space UK

We fully expect that most of these organisations will submit their own individual company responses to the Geospatial Commission consultation as well.

List of abbreviations used

ARD	Analysis-Ready Data
CEOS	Committee on Earth Observation Satellites
GEO	Group on Earth Observations
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
EO	Earth Observation
EOC	Earth Observation Committee
HAPS	High-Altitude Pseudo-Satellites
ISCF	Industrial Strategy Challenge Fund
NCEO	National Centre for Earth Observation
NERC	Natural Environment Research Council
OGC	Open Geospatial Consortium
R&D	Research and Development
SBAS	Satellite-Based Augmentation System
SEDAS	Sentinel Data Access System
STEM	Science, Technology, Engineering, Mathematics
STFC	Science and Technology Facilities Council
UKSA	United Kingdom Space Agency
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The definitions of geospatial data, positional data, and geospatial identifiers look OK. We would suggest that "geospatial services" should rather be "geospatial *products and services*" to include the outputs of the services. Key to us is the inclusion of satellite Earth Observation data in its different forms, including very high resolution video and still imagery from satellites, but also extending to data from high-altitude platforms (HAPS) and drones and in-situ networks of sensors such as traffic monitoring and air quality sensors. The definition should also extend to geo-located information from social media, mobile devices, news feeds, weather forecasts, climate models and similar.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The commission should focus on inspiring the next generation of geospatial and Earth observation data engineers and scientists. A programme of outreach into schools and universities to promote careers in this domain would be welcome, perhaps done in partnership with the UK Space Agency.

Sponsorship of postgraduate courses and programmes that enable STEM graduates to acquire specific geospatial and Earth observation data handling and

analysis skills would be valuable, as would sponsorship of industrial placements or apprenticeships in this field.

In particular, computer science graduates need to be skilled up in geospatial data processing, as many future apps will likely include a geospatial element; and in developing more user friendly interfaces to interact with geospatial data, to reduce the level of specialist skills and expertise needed in the end-user community to extract value from geospatial data.

In the mean time, there is also a need for education or reskilling of the end-users, particularly in the public sector, so that civil servants can make the best use of geospatial data in their departments and agencies.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

A key obstacle to growth of our member organisations has been the availability of talented engineers and scientists with relevant geospatial data analysis skills. Key gaps include:

- Geospatial data scientists
- Geographical information system (GIS) experts
- Earth observation data analysts / data scientists
- Earth observation data processing engineers
- Experts in big data analytics and application of machine learning and artificial intelligence to geospatial data.
- Programmers and software architects with geospatial data processing and applications development expertise

We are aware that the MOD invests significantly in training in geospatial data analysis skills (for example at the Royal School of Military Survey). It would be useful to connect trained personnel who are looking to leave the MOD with relevant opportunities in industry that are able to make use of this training.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The full value of Earth Observation data is only realised when analysed in conjunction with complementary public or private geospatial data sets. The UK lacks a coordinated data access solution that can bring together such data sets

and make them easily and operationally accessible to industry for exploitation. This includes for example existing governmental geospatial data such as from the Ordnance Survey, Hydrographic Office, British Geological Survey etc.

UK has invested piecemeal in various initiatives including UKSA investing in access to Copernicus Sentinel data via the SEDAS hub and STFC investing separately in the JASMIN facility which is predominantly for NERC use. None of these are suitable for full operational use (e.g. no out of hours support).

We would prefer to see the UK take a more holistic approach rather than investing piecemeal in disparate elements of a solution, and ensure that the infrastructures are designed and operated as fully operational systems meeting commercial service level standards for big-data infrastructures. The Geospatial Commission can play a key role here in coordinating the UK national approach to this.

At the same time, we recognise that there would be a cost to government for making geospatial data easily and freely accessible, and the cost needs to be justified by the benefits. We would support an evidence-based approach to data release and management that would allow government to experiement with putting parts of data into the public domain for industry to exploit on a trial basis, before committing to the full cost of release and maintenance.

Another area for the Commission's attention is how effectively the UK is making use of INSPIRE (https://data.gov.uk/inspire) to address some of the issues of geospatial data discovery, accessibility and interoperability that the UK is facing, and how effectively the UK Location initiative (https://data.gov.uk/location) is using INSPIRE.

Q5: Do you anticipate that any changes will be needed to both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We recognise that some applications could benefit from such changes but we are not in a position to assess these in detail, as address data is not extensively used in Earth Observation based geospatial services currently. There are likely to be several future applications that will rely on more precise address data, for example building subsidence or flood risk for insurance purposes, as these services need to be linked to individual buildings rather than postcodes alone which are relatively coarse.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

As per Q4, we would welcome a holistic approach to geospatial data access for the UK, which would bring together diverse satellite and terrestrial geospatial data sets along with the necessary storage and processing capacity, the tools to exploit the data, access to expertise and know-how, and the means to deliver resulting services to customers in the commercial and government sectors. These efforts should be joined up across the Geospatial Commission, the UK Space Agency (which is examining options for UK EO Data Access), the UK Space Sector Deal, and the ISCF Wave 3 "Space Data Revolution" challenge proposal, to enable an effective and coherent market for the UK.

Another key role for the commission would be to organise and coordinate the UK government's needs for geospatial information – essentially acting as 'intelligent customer' for geospatial information services on behalf of the UK government. This would enable industry to act as 'intelligent supplier' investing in key areas to meet government needs. If geospatial services can be operationally proven at significant scale with UK government users, UK industry will be in an excellent position to export the same services to governmental customers globally.

We would also ask the Commission to strongly support the efforts being made within the UK Space Agency and DEXEU to ensure that the UK remains a full participant in the EU Copernicus programme post-Brexit. Operational access to the free and open data from Copernicus is in itself of value to the UK, but the ability to participate in industrial contracts and to have a say in the future direction of the programme would provide immense additional value, for example in delivering future EO data sets that meet UK policy needs and priorities.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

If the UK continues to rely solely upon free and open data sources provided by Europe or other countries, we will never differentiate ourselves from any other nation vying for economic growth in this domain.

We see the biggest potential for economic growth coming from the exploitation of near-real-time, very high resolution, global data which can unlock the insights that help business and governments to make better, more timely decisions. This needs to be coupled with integration of new technologies (big data analytics, artificial intelligence, machine learning, data mining etc.); and development of user-friendly access and interfaces (including visualisation and interaction tools) to maximise derived benefit from the data.

As such, we would encourage the commission to support the growth and

evolution of the UK's capability to acquire and exploit its own very high resolution, near-real-time geospatial data sources, in particular focusing on technologies that give the UK a unique proposition – such as satellite video constellations, small radar constellations, thermal infrared sensors, hyperspectral sensors and other evolving technologies that build on UK industrial and research strengths and can differentiate us. We do not mean that UK government must build such systems itself, but should rather create the conditions whereby the private sector is able to invest in such technology development, by helping to mitigate the risks, be they in technology development, market uptake or raising of venture capital.

Another key differentiator for the UK is its reputation and ability to deliver trusted data with known heritage in terms of quality and integrity, and this is an aspect of UK capability that can be supported and promoted by the Geospatial Commission.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geospatial data and applications are already helping to transform many areas of industry and government, in areas such as in agriculture, transport, energy, conservation of natural resources, and responding to natural disasters. However there are many new applications of geospatial data that are yet to be conceived, for example in smart cities, smart energy, autonomous vehicles and more.

To support enhanced roll-out of future technologies, it is essential to make it easy for industry and researchers to access geospatial data and apply it in new areas of government and commerce. Geospatial data can also benefit from the application of new technologies such as AI and big data, 5G networks, etc.

It is also essential to invest in R&D of new applications and support the transition of that R&D in to demonstrations and onwards in to commercial applications. All future technology roll outs will need to have a geospatial component – EO needs to be part of this, or the UK will get left behind.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Many public sector organisations in the UK invest in their own infrastructure to maintain their geospatial data sets. This includes commission partner bodies (UKHO, BGS, OS etc.) as well as others such as the Met Office, STFC, Defra, several universities, NERC research centres (such as BAS and NOC) and the Satellite Applications Catapult, for Earth Observation data.

This approach tends to result in 'stovepipes' of geospatial data dispersed around

the country, each with different formats, standards, accessibility, licensing etc. The UK open data policy mandates public sector organisations to make all non-personal data available openly but each organisation is at a different stage of implementing this policy and it is particularly challenging for industry, academics or government bodies to access or even discover what data is available where. It also makes it difficult for all UK stakeholders (public and private) to exploit the synergies between these data sets.

Our preferred option would be for the commission to lead the way in establishing a common national mechanism for accessing geospatial data in which most if not all UK public sector organisations would be able to participate, adopting common standards, formats, interfaces, licences and data policies. This does not mean a common *physical* infrastructure: elements of the mechanism could still be hosted by different organisations, with focus on enabling interoperability and a common point and means of access for all UK stakeholders, public and private.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

We fully expect to see an increase in the number of geospatial applications that combine the use of Earth Observation and positioning technologies and exploit the synergies between them. For example, surveying applications that use GPS/GNSS technologies could be augmented with superior knowledge of the local terrain and 3D environment derived from Earth Observation.

Underpinning technologies to be prioritised should therefore include

- Access to high integrity / high precision GPS/GNSS sginals post Brexit;
- Alternatives to Satelite-based Augmentation Systems (SBAS) e.g. for areas where SBAS does not work well, and/or for improved resilience;
- Security (for anti-jamming & anti-spoofing);
- Plus information technology and big data analytics technologies already mentioned (see Q7)

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

We are strongly in favour of the UK public sector sourcing as much as possible of the development and maintenance of the underpinning infrastructure from the private sector, as long as there are checks and safeguards in place to ensure that this infrastructure is made accessible to all UK stakeholders on a fair and equitable basis. If the capability exists in the private sector, and is cost-effective and has adequate competition, then it does not make sense to duplicate this capability in the public sector.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

SMEs and large organisations have real issues navigating and negotiating data access, even for publicly purchased or provided datasets. Even data.gov.uk lists many datasets that cannot be systematically accessed, and there is no geospatially aware discovery mechanism. Public and private organisations need to be required and/or incentivised to make data public where possible, via standardised and easily accessible routes.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

See also our response to Q6. Essentially, this involves:

- Identifying current and future geospatial data requirements across all relevant government departments and agencies;
- Consolidating these and identifying areas of duplication or overlap, so that relevant geospatial data can be acquired once and used multiple times;
- Making the needs and requirements openly visible to industry, such that industry can plan its own investment and technology development to meet future public sector needs;
- Act as coordinating procurement agency on behalf of government, tendering for 'geospatial information as a service' with decent length contracts (e.g. 3-5 years) and associated operational service level and quality criteria;
- Ensure level playing field for large and small companies to respond to these procurements, and engage multiple providers to ensure quality, diversity and resilience of data supply.

This type of sophisticated approach would ensure value for money for UK government when procuring geospatial data/information services, whilst also encouraging UK industry to invest and ensure continuity of supply for future government needs.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

There are potentially numerous. Examples include insurance claims, crime statistics, accidents (road, domestic, industrial), traffic, footfall, noise, air pollution, news feeds, social media, elevation data, information on public utilities/services, electoral and census data, public transport data feeds, etc. As this data is currently difficult to access and exploit, the potential applications and use cases have not even started to be explored. A specific challenge would be the significant commercial and privacy issues around some of these data sets – certain types of data would likely need to be aggregated and/or anonymised.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allowing for national variations?

The Geospatial Commission should focus on setting a high level vision and ambition for the UK as a whole to achieve and benefit from superiority in geospatial data and information management and exploitation. As stated already, this vision and ambition should clearly include Earth Observation data and resulting information products within its remit. If this is done well, the national, regional and local authorities across the UK will be able to ensure that their own individual strategies, despite variations, work towards delivering the overall vision.

As a starting point, the nations and regions could be mandated to adopt a minimum set of common approaches, standards, interfaces and policies set out by the Geospatial Commission, with each free to exceed them, while remaining compatible. From an industry perspective, it is essential to adopt a straightforward approach which does not introduce new barriers – the strategy should be like an over-arching framework that permits national, regional and city level adaptations.

The UKspace Earth Observation Committee would be pleased to help the Geospatial Commission in defining this national strategy, if this would be helpful.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The key challenges here are (a) the lack of a clear and consistent set of standards and mechanisms for local authorities and other public sector organisations in the UK to record and share information regarding their services, and (b) the lack of any clear (centrally driven) incentives for them to do so. Leadership from the Geospatial Commission in this area will help to promote openness and sharing across these organisations.

Measures that are likely to help include:

- Develop common standards for all local authorities to adopt;
- Provide training and upskilling/reskilling amongst local authority users;
- Provide access to low-cost geospatial software tools;
- Develop a national geospatial data access mechanism (as per Q9) that local authorities are able to access and contribute to;
- Develop national geospatial data quality benchmarks/standards
- Establish special interest groups for knowledge sharing
- Share information and best practice through conferences / working groups

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

It is not clear why the Geospatial Commission has selected these 5 sectors specifically, as there are many others to consider, including financial services, healthcare, insurance, smart cities, climate & energy, maritime and border security, and many others. Each of these has several potential geospatial applications within them. The UKspace EOC would be pleased to organise and participate in a workshop, with stakeholders from across the industry, to explore these in more detail with the Geospatial Commission.

Q18: Are there any other areas that we should look at as a priority?

We would like to see the Geospatial Commission encourage development and adoption of applications using remote sensing and Earth Observation across UK government. As data analytics and applications that integrate satellite, drones, high altitude platforms and other data emerge and evolve, along with complementing big data technologies like artificial intelligence and machine learning, the Geospatial Commission should ensure that these vital capabilities (in which the UK has excellent heritage) are clearly adopted and exploited as part of the national geospatial strategy. Remote sensing has numerous applications across government in helping to deliver policy priorities and monitor effectiveness of these policies; and any services developed in the UK to meet national requirements are readily exploitable by industry in commercial export markets.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

There are many potential public and private sector innovations that would be unleashed by better access to geospatial data, including many that haven't even been thought of yet. As with Q17, the most effective way to flesh these out may be through a workshop with industry stakeholders

Potential regulatory challenges include:

- regulation around the use of HAPS, drones, autonomous vehicles and other aerial or terrestrial platforms to collect geospatial data;
- privacy issues including confidentiality and security of geospatial data that may allow individuals to be identified;
- regulation around the launch and operations of UK-owned commercial satellite constellations

In the context of Brexit, the UK also needs to ensure that adequate support is given to export initiatives through high value campaigns, trade missions, and promotion of UK geospatial capability in the international arena.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

For the UK to become a world leader it needs to foster development of scalable, operational propositions which industry can then exploit in international markets.

To enable this, the UK urgently requires a joined-up national approach to collecting, storing, sharing, disseminating and exploiting global geospatial data sets, which brings together UK stakeholders from across industry, research, academia and government working together towards a common goal.

The Geospatial Commission is uniquely placed and funded to make this happen, working closely with the other key initiatives, notably the UK Space Agency's efforts to provide operational EO data access for the UK, the UK Space Sector Deal, the ISCF Wave 3 "Space Data Revolution" proposal, and the export initiatives of the Department for International Trade. With Geospatial Commission leadership and coordination, the UK can create a highly visible showcase for British technology and capability worldwide, highlighting its reputation for delivery of trusted, high-integrity geospatial data and resulting information products.

Once we have a coherent national approach, UK capability and services will speak for themselves in the international geospatial world. There are also several international fora where the Geospatial Commission can actively promote UK capability – for example CEOS, UN-GGIM, GEO or the International Charter for Space and Natural Disasters – working closely with UKSA, Defra and other relevant UK bodies.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

The European Copernicus DIAS platforms are rapidly becoming centres of gravity for hosting EO and complementary non-EO geospatial data in Europe, along with relevant tools, storage and processing capacity to exploit the data, and with e-Commerce facilities to enable commercial applications to be built and served.

Australia has invested significantly in its open data cube implementation, which has now been embraced by CEOS. Some states like Queensland are routinely procuring state-wide high resolution coverage on an annual basis and making it available to its public services.

France and Germany have invested significantly in national EO data centres (PEPS and CODE-DE respectively). The Netherlands is routinely purchasing satellite data coverages of the country, as well as collecting Sentinel 1 and 2 data, and making raw and pre-processed ARD freely and openly accessible to Dutch users from government and industry.

In terms of geospatial big data implementation, North America is leading the way. The USA has established a national geospatial platform (www.geoplatform.gov) and Canada is establishing its own Federal Geospatial Platform. In the private sector, North American organisations such as Amazon, Google, Planet, Maxar/DigitalGlobe, BlackSky, Urthecast and others are investing heavily in this

domain, recognising the commercial potential.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	University of Edinburgh, School of Geosciences & EDINA
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	**X**
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**X**
Medium business (50 to 250)	

Small business (10 to 49)	
Micro business (up to 9)	
Other - please state	**Academic institution**

Background Information on Respondents

This response to the call for evidence is a consolidated one from the University of Edinburgh and comprises input from EDINA and the School of Geosciences. For information a little background to each is provided.

EDINA @ University of Edinburgh

EDINA is a world-class centre for digital expertise, developing unique technology solutions for the UK academic and public sectors as well as external clients. Operating as a stand-alone business unit, based in the University of Edinburgh, EDINA has circa 40 staff, comprising software developers, project managers, service support and business development, and has a £3m annual turnover. EDINA has an 'intrapreneurial' role within the University of Edinburgh working in collaboration with all three Colleges, as well as established external partnerships in the private sector and with funders (such as ESRC) across the UK and internationally.

In existence for over 20 years, EDINA runs (*inter alia*) an established geospatial data and mapping platform (Digimap - digimap.edina.ac.uk) providing subscription based services for the UK education sector, which it delivers to 130 Higher Education Institutions, 360 Colleges and 3000 schools and is in daily use by around 65,000 users. EDINA has developed and supported theses services (including running a bespoke Helpdesk servicing around 5000 annual support queries), and provides extensive online learning and training resources.

Digimap offers a range of online web based clients to create customised maps and to perform custom data extraction operations against a wide range of large commercially valuable geospatial data collections that currently include:

- **OS Digimap** - access to large scale Ordnance Survey® data.
- **Historic Digimap** - historic maps from Landmark Information Group.
- **Geology Digimap** - geological maps and data from the British Geological Survey.
- **Marine Digimap** - hydrographic maps and data from (at writing) SeaZone Solutions.
- **Environment Digimap** - Land Cover Maps and data from the Centre for Ecology & Hydrology (CEH).
- **Aerial Digimap** - high resolution Aerial Imagery data from Getmapping Plc.
- **Lidar Digimap** - high resolution Lidar data from national UK agencies.
- **Global Digimap** - access to Open Street Map and Natural Earth data collections.

Geosciences @ University of Edinburgh

The School of Geociences at University of Edinburgh is the largest and most successful interdisciplinary grouping of geoscientists and geographers in the UK, with a growing and cosmopolitan academic and research staff of more than 300 academic and research staff; more than 100 non-academic staff; around 470 postgraduates (half of whom are on taught masters courses), and over 1,100 undergraduates.

The School was formed in 2002 through the merger of the former Institute of Ecology and Resource Management, the Department of Geography, the Department of Geology and Geophysics, the Institute for Meteorology and Environmental Chemistry from the Department of Chemistry - all of which have had a long history within the university, dating back to the eighteenth and nineteenth century, and influenced by an impressive selection of scientists and social scientists who have shaped the School's core disciplines (ecology, environmental sciences, geography, geology, geophysics, meteorology, oceanography) and areas of expertise.

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Broadly yes though we would distinguish between core framework GI data and ancillary positional/location data in which the geography component is often of secondary importance. Spatial data as a type is important and while we should resist adopting a 'spatial is special' epithet, the importance of place and a geography to link other datasets together cannot be underestimated.

It is of concern that partner agencies do not include the fields of transport, the environment, health and their associated datasets, together with earth observation (EO) data. We would encourage the broadest possible definition of spatial data.

We would expect to see some reference to attribute data – not as a specific geospatial data type but at least recognition that it is a combination of geospatial reference data with attribute data that then enables analysis/modelling.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The University of Edinburgh is a leading provider of education and training in geospatial, with some of the world's longest established Masters programmes in GIS and EO, together with training of researchers and professionals, and provision of geospatial skills to schools. Our community (the Higher and Further Education aka Higher Education Institutions (HEIs) and Schools sectors) are already a heavy GI consumer through sectoral licensing agreements and a range of services that we provide. Our users are often subject experts but their use of geospatial data requires them to acquire and develop additional skills in geospatial data handling. Critically, the geospatial communities we serve are cross domain and cross disciplinary. Spatial data is not just used by geographers but is used across all disciplines.

However, as acknowledged nearly a decade ago [https://www.ratswd.de/download/RatSWD_WP_2009/RatSWD_WP_88.pdf] there are significant skills gaps and lack of coherence in both skills delivery and appreciation of the geospatial tooling and infrastructure already available. Spatial literacy is frequently under appreciated yet permeates most day-to-day activities in a digital society (from simple route navigation and map reading to sophisticated spatial analyses for service planning and delivery). In that respect the trend in the erosion of geography as a core subject area in schools whilst the increasing employability of geography graduates provides a mixed picture in terms of geospatial skills development. Geographical skills are more relevant today than ever before and an appreciation of spatial/GI should be a core ambition of the Commission - not just to geospatial professionals but to lay GI users across all

sectors.

The commission should thus focus upon curriculum setters/examination boards across all nations to introduce spatial literacy explicitly into the curriculum. The commission should emphasise how critical spatial literacy skills can be to developing critical thinking and data handling skills in pupils, especially when presented with geospatial data/themes for their local areas. This is not about getting GIS into schools per se - it is about developing spatial literacy and geospatial competencies to ensure students have the skills required that will be increasingly in demand in a growing employment sector.

While there is relatively good degree-level education, providing a steady supply of GI professionals, it is not clear that this provision will meet growing and future demand.

At technician level, provision is poor. Despite the existence of Scottish Qualifications Authority mandated qualifications, few FEIs offer these and the uptake by students these has been virtually non-existent. There is little or no precedent for apprenticeships within the industry, and companies do little to promote GI/EO as a career beyond their own walls. Expertise among teachers within the discipline of school geography is low, and again there is little recognition of GI/EO as a career pathway. The Commission should urgently address these issues, perhaps by encouraging partnerships across geography, a broader environmental curriculum and ICT.

In general, the advent of increasing amounts of EO and sensor data (IoT) suggest that a deficit in skills in these areas could stifle adoption. Similarly, and not unrelated, the skills required for advanced interpretation of GI using AI/ML approaches is another area where there will likely be a critical shortfall of appropriately skilled personnel. The Commission should consider urgently plans on how to address this - possibly through encouraging Data Apprenticeships and journeyman routes such as being pioneered by e.g. ONS Data Campus, including ONS's collaboration with EDINA at the University of Edinburgh, to leverage and grow a cross curricula, geospatial service that is already being delivered into 3000 schools UK wide.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

As previously mentioned, the range of skills required is broad as is the potential audience to whom such skills are relevant. Organizations (HEIs) tend to address these pragmatically but in an uncoordinated and piecemeal fashion. A core GI Body Of Knowledge should be promulgated and adequate formal and informal qualifications and accreditation courses be rationalized in an effort to instill a sense of pride in a profession that is frequently underplayed - as attested by careers routes for new graduates, CPD routes and general recognition. The Commission should liaise closely with bodies such as AGI, GA, RGS, RSGS, IBG, RICS, BCS to rationalize and standardize the GI skills landscape. Variety is both a strength and a weakness - at minimum better signposting and options summaries for aspiring career professionals would assist.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

While recent developments including the INSPIRE regulations have encouraged a culture of making more data available, there is still much to be done. Complex access procedures (and cost) remain barriers to effective research. All parties need to do more to provide web mapping services (WMS and WFS) which can provide data in real-time from host organisations. Consistency of provision and access is to be encouraged; data.gov.uk lacks organisation and structure.

There is concern that the Commission does not have partnerships with the likes of the Highways Agency, Environment Agency, Met Office, Historic England and many others who are important producers of geospatial information. There is particular concern that the Commission is not partnered with the Scottish equivalents of these agencies, and also the Scottish equivalents of HMLR (the Registers for Scotland) and the Valuations Agency (Scottish Assessors). The Commission needs to address this shortcoming in a formal manner, otherwise an important part of the UK will potentially miss out on Commission-led developments.

The UK higher education community has long wanted access to detailed addressing and postcode products but residual and confusing IPR have meant that this is problematic and has acted as an impediment to research. Removing or at least simplifying routes to access fro this information for teaching and research purposes would add substantial value to UK GI research. To a lesser degree other data sets such as a timely and consistent view of UK land use data would be valuable for research. The UK academic sector has (for many years) benefited from licensed access to OSMM and other ‘core’ GI datasets such as BGS data although specific datasets such as e.g. the radon dataset remain problematic to access. Some of this is due to cost, some to 3rd party residual IPR and some due to a general lack of awareness of whats available. Even where open data are available it is not always readily apparent where and how to access or even that

data exist. Whilst data.gov.uk solves some of this there is still too much fragmentation in providing a coherent, consistent and canonical view of what data are available under what conditions. EDINA have long promoted interoperability through standardised metadata (and are heavily involved in UK GEMINI) but wide-scale adoption and promotion (AGI efforts notwithstanding) remains illusive (both within and without academia). Services, tools and education to address the 'know what we have' problem remains as much needed today as it did at the time of GIGateway and its successors.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We note and welcome the opening up of key parts of Ordnance Survey's Mastermap product family such as property extents and TOIDs However,these do not provide the essential link between everyday addressing and the digital geospatial infrastructure. Addresses matter because, regardless of the locational referencing standards adopted by government and geospatial technology companies, textual addresses remain the most universally used form of locational information among the general population. Addresses are the locations at which most journeys begin and end, the descriptors of properties that are bought and sold, the spatial positions which qualify individuals to access services and receive benefits. It is therefore textual address information held within the National Address Gazetteer and not the TOID or spatial coordinates which provides the only linkage field for many key datasets, ranging across NHS registration, social survey data and many other customer and government databases. The continuing lack of an open register linking addresses to definitive identifiers obstructs data linkage, research and innovation at many levels and produces inconsistent results when alternative approximations are used.

The case for an open address register has received extensive attention e.g. by the Open Data Institute and government-commissioned reviews, for example the Independent report for government on the feasibility of an open address gazetteer https://www.gov.uk/government/publications/an-open-national-address-gazetteer whose recommendation was "that a basic address product should be free to all users at the point of use under the Open Government Licence". This continues to be a priority if the value of geospatial information is to be fully realised.

Vast amounts of spatial data are now being contributed by volunteers through smartphone apps and other non-traditional means; the Commission should address issues of accessibility of these new forms of data.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

As noted earlier, the main threat to the UKs ability to best exploit the explosion in EO data and its potential applications is one of data skills and the currently rarefied skill matrix required to intersect both EO interpretation with machine intelligence. EO + AI could revolutionize GI data exploitation and its real world application to large societal challenges yet the numbers of the work force with the skills required to avail of this are negligible. Whilst not unique in as much that data science skills are generally at a premium, the additional GI specific challenge afforded by EO means that the UK market (public and private) is ill placed to swiftly capitalize upon the 'space data revolution'. A curricula of industry relevant core skills allied with their educational provision is urgently required.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Emerging - EO + AI; IoT; Wearables;autonomous vehicles; location smart contracts;

Established (variable maturity) UAVs, BIM, 3D, AR/VR; Indoor location

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Geography and therefore the use of spatial data is both ubiquitous and often unexpected. Using outdoor and indoor location methods, web location and suchlike, recording location has become easy and will be embedded in new applications. Understanding how this data can and should be used will become crucial as applications move into non-traditional fields.

There may be issues of data protection and personal security which the Commission needs to address in conjunction with the Information Commissioner(s).

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

The various options for a ‘solution’ to this have been exhaustively explored over a number of years - from making data completely open in the hope of generating private sector innovation, to cross-subsidy models that generally involve pay-for-use. The core issue we believe is negotiating a balance between public good and private profit. We suggest a more collaborative public:private model where both ‘sides’ can exchange value (not necessarily in solely monetary terms but also in terms of knowledge exchange, best practice and skill development). Where chargings need to remain an important part of the business model of organisations such as Ordnance Survey and the Hydrographic Office, we encourage a link between cost and value; where those organisations making significant financial gain from the data contribute to its costs of maintenance and collection, whereas small businesses, those operating in a personal capacity, teaching and research should benefit from free availability.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

GPS (assuming no Galileo access post-Brexit), indoor positioning and general geodetic revision to avail of new more precise positioning technologies.

Certain core geographies should be freely available; including addresses and an extensive placename gazetteer. These are crucial in terms of creating linked data.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK’s geospatial data assets?

A key role although set within the Vision owned and driven by the Commission on behalf of UK taxpayers.

It is important that the Commission engages with the private (and third) sectors in terms of data availability and to simplify the arrangements where data is being used for research purposes in conjunction with commercial organisations.

The Commission should encourage mutually beneficial public-private partnerships to ensure, for example, popular web mapping offerings are enriched, but equally that resurvey and maintenance costs are shared. It is ultimately in the public good that effort is shared.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

As previously noted, major challenges including knowing what geospatial data exist and having them available in an easily consumable form (WMS/WFS) remain issues. Adopting common metadata standards to describe extant data holdings provides one remedy. Even where data are discoverable and their fitness for purposes can be assessed, often the data format or data volumes may prove challenging. The geospatial interoperability standards promoted by both OGC and enacted via INSPIRE in the public sector are partial solutions. However, many of the technocratic solutions are arguably too complex and can themselves act as barriers to adoption. A policy that adopts a principle of 'only as complex as the solution demands' needs to be pioneered which would allow for a richer ecosystem of geospatial services at varying degrees of technical complexity whilst observing the essential precept - build once, use many times. Many users only want GI data to solve a problem, not as an end in itself and therefore the GI component may be better viewed as an invisible enabler - this is likely even more true for EO applications where size and complexity become even more obvious. More prosaically, much geospatial data is administrative in nature, and there remain major challenges of data access and consistency across government. A major step forward would be achieved if e.g. validated standard addresses were used more consistently at the point of entry across government organizations, including NHS and DWP/HMRC so that high quality information on households and services is consistently generated and therefore more readily linked and georeferenced. This would greatly facilitate administrative data research (which in UK HE has been the subject of substantial research council funding) and would also be supportive of the government's declared intention to move towards an administratively-based census after 2021. Standards already exist to enable much of this work and much has already been accomplished. There is however much more to do.

Data.gov.uk is barely fit for purpose.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The UK academic sector is currently not covered either by the existing Public Sector Mapping Agreement (or the Scottish equivalent) with the result that there is no national academic access mechanism for definitive datasets such as PAF . This impedes not only the ability to help meet identified needs for geospatial skills training but also leads to unnecessary expenditure of public funding - for example through UKRI and UK research councils' funding being used to repeatedly purchase small extracts from products for defined projects. Wrapping these products into existing national licensing agreements to the academic sector could help reduce overall expense and assist rather than frustrate primary research.

At a general level we would question the existence of a data marketplace within the public and third sectors - at least one that is principally compelled by economics over social good.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We have noted following above but repeat here for emphasis. There is concern that the Commission does not have partnerships with the likes of the Highways Agency, Environment Agency, Met Office, Historic England and many others who are important producers of geospatial information. There is particular concern that the Commission is not partnered with the Scottish equivalents of these agencies, and also the Scottish equivalents of HMLR (the Registers for Scotland) and the Valuations Agency (Scottish Assessors). The Commission needs to address this shortcoming in a formal manner, otherwise an important part of the UK will miss out on Commission-led developments.

Much government administrative data is either implicitly or explicitly geospatial in nature yet remains siloed or unobtainable (often even to other government

departments). Establishing a canonical catalogue of such data allied with the adoption of clear (and simply worded) data sharing agreements could greatly assist in better exploitation of valuable GI assets. Accepting that many such datasets may contain confidential or disclosive information, the Commission should consider how modern data linkage techniques (using anonymity preserving one-way data hashing algorithms) could free up 'sensitive geospatial data'. This may also unleash serendipitous data associations as the full value of data fusion is finally realised.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

The ubiquitous nature of geography, and therefore geographical information, means it remains a challenge to define a user community. The Commission should use existing networks, and encourage the development of new ones, to share best practice and deliver better public services.

Sections of academia already work closely with local authorities via e.g. the Business and Local Government Data Research Centre; the Urban Big Data Centre; the UK Data Service. Formalising these relationships via e.g. a Commission-sponsored Local Government and Academia Network would mutually assist both local government and researchers. A single recognized fora would make it easier for experts on both sides of the divide to exchange and share best practices. The separation between academic research and local government practise is often a question of ensuring that both sides can successfully meet. Commission supported networking events (possibly enacted through or mediated by AGI) could assist.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

UK academia has significant interest across all of the above sectors so its is hard to chose just a single category. One additional significant area of research is health and population studies - especially those relating to greenspace and health. We would agree re health data and would provide comment that we are surprised on emphasis within the paper upon physical features – topographic, marine and geological as opposed to 'human' socio-economic data incl health, wealth distribution, life expectancy etc. Arguably these are attributes of geospatial data hence reference to response to question 1.

Just as location-based services have developed for the smartphone, there will be new categories which will develop in coming years in a fast-moving field. The availability of richer EO data and new technologies such as the IoT will bring applications as yet unimagined, across the above and many other sectors.

Q17: Are there any other areas that we should look at as a priority?

Address and Postcode data
Population and migration data.
Landcover data
Interaction and flow data (people, goods, services)
High value environmental data e.g. high resolution LiDAR/ Green LiDAR
Sensor network feeds from Smart City initiatives
Commercial data from private sector such as geodemographics data
Utilities geospatial data
Network/4g/5g data

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

EO data, UAV data and IoT devices all have the potential to vastly increase the availability and application of GI in the UK but each poses its own regulatory challenges relating most significantly to privacy and safety. UAVs (and autonomous vehicles more broadly) given their mass market appeal and their potential nuisance and safety risks pose particular challenges for adoption.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

By leading by example and better showcasing UK talent - much of which emanates from UK education institutions and private industry. International exchanges, trade shows and knowledge exchange partnerships can all help but better exploitation of GI in the home market will, in and of itself, underline the UK's interest in and mastery of GI data and technologies. Success on the domestic front will draw International interest.

The UK's international profile is currently limited to the residual role of their former Overseas Survey, vested in OS (OSI).

The UK does not take any significant role in the way of the NGDC and USGS in the USA, which take responsibility for collating and being the source of international databases (eg. DEMs, earthquakes). Where could the UK lead, could the UKHO make available historical ocean data? There are opportunities in terms of new EO data collected by the UK.

We can capitalise on this through offering an international marketplace for our expertise.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Australia (CSIRO) ,NZ (Landcare), US (NGA), EU (Eurogeographics) as well as OGC Europe. However no single country has a monopoly in all the areas geospatial covers and therefore one would need to isolate best practice in any given domain. .Many of the existing European Mapping and Cadastral Agencies have initiatives and experiences that UK could better make use of through engagement with e.g. EuroSDR and AGILE

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Individual, University of Leicester
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

It is not entirely accurate. Geospatial data generally fall into two categories: raster and vector data. Data for which place is a key feature of its source and purpose is generally called geographic data.
Data is not the same as information, either. These terms should not be used interchangeably.
Geospatial data should also be differenciated from georeferenced data.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Additional areas where the UK needs skills for the future include satellite remote sensing, cloud computing, data analytics and programming, especially Python, integration of information from multiple data platforms to quality control and support interpretation of information from EO. These could include surface observations and models of varying types and complexities (e.g. box models and detailed Earth System Models).

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

The University of Leicester needs highly skilled researchers with experience in radar, LiDAR and multispectral remote sensing, cloud computing, data analytics and programming, especially Python and R. General Earth system science skills and an understanding of the climate system are also needed.
These skills requirements can be most effectively addressed through postgraduate taught courses at MSc level and postgraduate research programmes (PhD and MPhil), complemented by continuous professional development (CPD) events for existing research staff.
Demand for these skills is higher than supply. This deficit could be addressed by injecting increased funding into training the next generation of geospatial experts. This would ideally take the form of MSc and PhD scholarships in a research group with a focus on downstream applications of Earth Observation (EO). The student experience would be enhanced by a short-term placement at an EO company after sufficient training has taken place.

PhD training is more effective than short-term or online courses for building the foundation of specialised skills in data use, analysis and interpretation. After that, short-term and online courses offer a useful mechanism for keeping pace with new developments and techology/tool updates.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The UK national land cover maps at the Centre for Ecology and Hydrology (CEH) are prohibitively expensive.
The Countryside Survey data at CEH would be valuable, but are inaccessible.
Anonymise data on crop types and land use from the Rural Payments Agency would also be valuable.
All these datasets would be valuable as training and validation datasets for non-profit research.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

We are not providing a response to this question.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The UK needs to secure continuity of involvement in the European Copernicus Programme to retain access of UK industry and academia to tenders and contracts for developing the next generation of Copernicus, as these data will drive future growth in the downstream market. Continued access to Horizon 2020 and future research framework programmes are very important for universities to maintain our international collaborations with Europe.
Free and open access and data continuity with a longevity of operational missions, following the Copernicus model, are important to develop the UK's capability.
Access to high performance and cloud computing services for developing prototype EO applications before they go to market are valuable, e.g. CEDA / CEMS.
Observations of air pollutants at higher spatial resolution than is achieved with the current instruments in space. The current fleet provide valuable information about long-term changes in air quality over wide domains (~7-20 km), but the resolution isn't high enough to identufy partiuclar polluters, to link pollution to exposure and

negative health effects, and assess the efficacy of clean air zones. The value is substiantial improve air quality tools to effectively develop policies that mitigate premature deaths (40,000 per year in the UK), crippling fines for infringements (more than £100 million per year to the UK), and and estimated £20 billion per year in health care costs.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Key development areas in Earth observation include hyperspectral Earth observation, multi-wavelength LiDAR and free and open data from L-band Synthetic Aperture Radar (SAR).
Augmented reality and virtual reality as a device to communicate and visualise the information these datasets provide.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Enhanced roll-out can be achieved through platforms allowing free and open access to demonstration datasets and services. Standardised data streams and user portals would be helpful.
Maintaining compliance with the INSPIRE Directive is strongly advisable.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public sector organisations need to provide secure long-term investment in framework contracts for collecting environmental and other geospatial data in order to monitor changes. Such contracts would best go to organisations with monitoring and data provision remits such as the Natural Environmental Research Council's centres and surveys (BGS, CEH etc.) and Defra.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

Continuity of involvement in GNSS and continued innovation of its locational accuracy are important.
Rapid data access through upgraded internet bandwidth in all regions of the UK is required to get geospatial data to all possible users.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

The role of the private sector is threefold:

1. Innovation of Earth observation hardware (future satellite instruments and technology etc.), geospatial infrastructures, algorithms and data portals through collaborative activities with academia
2. Delivery of cost-efficient infrastructure to enable data access
3. Contracted service provider to add value to datasets and turn data into information

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to

improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Challenges that we have faced include overcharging for geospatial data even though their production was paid for from public funds (e.g. UK land cover map by CEH), lack of access with reference to confidentiality (e.g. Rural Payments Agency, Defra Countryside Survey) and difficulties finding the dataset we were looking for but did not know existed. Datasets are held by a myriad of departments, centres and agencies, and for lay people it is almost impossible to find what they are looking for.
A central data catalogue of all public datasets would be very helpful, in accordance with the GEO principles.
For datasets subject to some degree of confidentiality, a suitably anonymised form of the data should be made available.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Commission can provide focus and support a one-stop data catalogue for all public geospatial datasets. This could be coordinated with the GEO Data Portal.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

We are not providing a response to this question.

Q15: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Shared geospatial service centres are an effective way of supporting multiple local authorities in accessing data.

Q16: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Natural Capital valuation and ecosystem services valuation can underpin Payment for Ecosystem Services Schemes (PES).

Q17: Are there any other areas that we should look at as a priority?

We are not providing a response to this question.

Q18: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Space-based data for climate and models: Space-based geospatial data are increasingly used for climate research and for providing independent evidence of the magnitude and impacts of climate change. New analysis methods for geospatial climate data records to advance the understanding of global climate change and research enabling the collection of new climate observations are needed to advance knowledge in this field. Development of an easy-to-use climate data assimilation tool into models would be an exciting innovation that would enable more researchers to use these techniques. Joining land surface and atmosphere models, e.g. JULES and GEOS-CHEM, would allow new advances in knowledge of land/climate feedbacks. UK leadership of major initiatives such as the ESA climate change initiative, the Copernicus Climate Service and the Copernicus Land Monitoring Service prove our track record.

Urban environments and human health: Air quality and urban heat islands have detrimental impacts on human health. Urban green spaces can mitigate these pressures, which still present a major environmental challenge to the UK and many other countries around the world. Earth observaitons of atmospheric composition to monitor air quality at high enough spatial resolution to assess the impact on health and the terrestrial biosphere are needed.

EO data science: The EO data revolution is leading to rapidly growing amounts of available space data which create challenges to the development of new downstream applications. New satellite missions generate ~1Tb of data per day with a wide range of applications for cities, agriculture, air quality, biodiversity, flooding etc. Advanced retrieval techniques as well as cloud computing and big data analytics, such as machine learning and artificial intelligence, are needed to realise the full potential of contemporary space infrastructure and the data it generates. Smartphone apps can contribute to democratising EO data access.

EO for sustainable development: Geospatial data support and enable the pursuit of the United Nations Sustainable Development Goals, which aim to solve some of today's most pressing development problems, including the rapid loss of tropical forests, availability of sufficient amounts of clean water and unsustainable land use change, as well as air quality, climate risks to food security and agriculture.

EO instrumentation and missions: UK researchers have strong links to European and international satellite missions. The research field of development of instrumentation and new missions is an area with continued, strong investment by UKSA and ESA. UKSA has growing interest in both national and in bilateral missions in addition to the UK investment into ESA. Opportunities exist especially in airborne demonstrators and in instrument bread boarding in key technologies supported by the UKSA CEOI programme.

Q19: How best can we make the UK's presence in the international geospatial world more visible?

Programmes such as the UKSA International Partnership Programme (IPP) are a great way for UK industry to access international markets.
Increased engagement with the Group on Earth Observations (GEO) and the Committee for Earth Observation Satellites (CEOS) will make the UK's presence more visible. Programmes such as IPP should review which activities can be badged as GEO.

Q20: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

More funding opportunities that promote collaboration with international researchers and policymakers and exchange of best practice ideas.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text Redacted]
Organisation	School of Geography, Geology and the Environment, University of Leicester
Job title	[Text Redacted]
Address	[Text Redacted]
E-mail	[Text Redacted]
Telephone	[Text Redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	**X**
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

- **Data v information**

The classes of use would seem about right. However, the descriptors mix both 'data' and 'information'. Data is more fundamental/foundational and an argument could be made that it is the role of geospatial analytics/GIS/geocomputation etc to unlock the information from the data. Primarily, the subject of information in the 'call for evidence' is about *data*. The important link to *information* needs to be emphasised, however this is distinct.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

- **Spatial literacy**

To further the work being done in the UK and US to embed spatial skills and spatial literacy concepts across diverse curricula at secondary and tertiary levels of education.

- **Spatial data science**

At present new developments in Higher Education (HE) in the US (usually a good weather vane of disciplinary trends) is very much in two areas: (1) *Spatial Data Science* and how this can complement existing geospatial skills in GIS and EO programmes (2) *professional science masters* providing business skills alongside geospatial skills.

- **Reproducibility**

As many other quantitative sciences, there is an urgent need for assure the reproducibility of research results, in academia as well as in the business and policy sector. This is crucial to promote reliability and transparency. At the moment there is a lack of both practice and teaching of reproducibility approaches in GIScience.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

- **Science and applications**

Geospatial skills needs encompass both experts/expertise in the science behind GIS/geospatial skills (i.e., GIScience) and in their downstream application of the technology (e.g. using GIS). There is a general lack of GIS expertise with high-level programming/ database skills to meet the demands of processing/analysing data in the academic sector. It is consequently very difficult to obtain and retain staff.

- **Stakeholders**

The first obstacle to the effective support of geospatial careers wither reference to GIS has historically been the multiplicity of stakeholders (AGI, RGS-IBG, JISC, RICS etc) in the public and private sectors. Hopefully the geospatial commission by its very existence will enable more collaboration between these stakeholders to the benefit of all. Allied to this are issues related to professionalization. Efforts have been made to offer CGEOG(GIS) via RGS-IBG/AGI but this could be augmented and linked to organisations such as RSPSoc.

- **Long/medium term financial support in HE**

Over the last 30 years the history of government support for geospatial teaching programmes/research in HE has been spatially/temporally very piecemeal with periods of support provided by UKRI via ESRC, NERC and HEFCE. Some schemes have had a research focus (ESRC's RRL initiative) some a teaching focus (NERC PGT support, HEFCE CETLs). Since the withdrawal of NERC-

funding for PGT (level 7) HE in the UK, there has been no direct UKRI supported initiative for the teaching of geospatial skills at level 7. In order to develop geospatial skills appropriately in HE it would be very helpful if such support were available, often translating into student scholarships. . Post-BREXIT, support will be even more critical. In contrast, the USA's NSF has more continuity in terms of centres of excellence funded for longer periods of time, supporting *both* research and teaching.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

- **OS and ONS data access**

The OS and ONS data holdings are currently not as free of use restrictions as are similar data holdings for example in the USA. As a teacher and researcher in GIS with 20+ years of experience, the difficulties this has generated for my/students use have been profound and necessitated the frequent use of non-UK geospatial data for both teaching and research. Although the situation has improved in recent years with much data becoming available via various forms of OGL, the OGL environment is still complex to disentangle from the end-user perspective, particularly when looking at historic data. In particular there are still OS datasets that are not available under the OGL, and several forms of OGL. The obvious solution would be at least to bring all geospatial data into the *same* OGL framework or, perhaps even more preferable would be to explore options of a data supply framework with even *fewer* restrictions (completely free access).

- **Public data samples**

There is a wide-spread use of datasets from internet platforms (e.g. Twitter) in many fields of research, both quantitative and qualitative. The fact that every researcher is required to collect their own data from these platforms is problematic in two core aspects. First, it creates a reproducibility issue, as well as a transparency one, as datasets are different for each piece of research and inaccessible to other researchers. Second, it creates a divide between researchers and institution that can invest time, money, and equipment in collecting and maintaining the dataset, and those that cannot. A public sample dataset of the most used dataset made available by a government agency would provide a common point of reference for all the work in a variety of fields in geography, computer science, social sciences, and more.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

No comment.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

- **Long/medium term financial support in HE**

Again, I would argue that supporting HE with funding for specialist geospatial programmes (both taught and research) would facilitate the flow of professionals into the sector.

- **Accessible analysis-ready data**

Certainly the current trend toward analysis ready data for EO ought to be continued. One of the historic problems (well-known in the EO community over the last 20 years) is that the ability to *collect* data outstrips the ability to analyse. Hence, archived data ought to be as open as possible to allow maximum use. The reference to US Landsat data (page 16 in the call for evidence document) conveniently (possibly accidentally) reinforces the point of EO data from the US being historically much more accessible than UK/EU products.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

- **Drones**

Drone technologies/UAVs have revolutionised the real time collection of imagery over small areas/largely scales. Supporting the sensible use of such technology, including an appropriate legislation framework for collection and use of derived data could be one avenue.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

- **Open access data**

Clearly, more accessible data would encourage technology roll-out. There seems limited use in developing proof-of-concept technologies which are dependent on often expensive (and possibly prohibitively restrictive) data licences!

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

No comment.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

- **GNSS access**

The answer to this very much depends on the outcome of BREXIT negotiations and our access (or not) to GALILEO/something similar. Clearly the UK will require a similar level of access to GNSS data to that it currently enjoys..

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

- **Core infrastructure**

The core infrastructure and R&D should be directly maintained by the government/public sector. It is unlikely that the continuity of service/supply could be guaranteed in any other way.

- **Public/private joint ventures**

Obviously the private sector needs to be involved in R&D and in this case, this may be best served in the form of public-private joint-ventures.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

- **Data accessibility**

Make *more* geospatial data available through https://data.gov.uk

- **Harmonise licencing**

For example, the OGL licence is available in three versions (plus Welsh)! See http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

- **Harmonise interoperability of standards and metadata**

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

- **Broker data access agreements**

If there is no default open data option then, the geospatial commission should act as a data access broker for the whole public sector.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

- **Health care data**

Although there are clear problems, from the perspective of use of geospatial data in a public health context, better access to health care data (where possible) would be beneficial.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

No comment

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

No comment

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**

- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

No comment

Q18: Are there any other areas that we should look at as a priority?

- **Environment**

Although 'natural resources' may cover elements of the environment, both natural environments and social (also urban) environments surely warrant specific focus from a variety of contexts (climate change focus, environmental impact of flooding etc). The involvement of the Environment Agency as a key stakeholder would be advisable, particularly since they generate large quantities of geospatial data.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

No comment.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

- **Sustained investment in education**

Medium to long-term strategic investment in training in geospatial skills at all levels of education.

- **Targeted research initiatives**

The constituent bodies making up UKRI mean that anything GIScience/ Geospatial is usually of secondary importance in relation to the primary science mission of bodies such as NERC for example. Geospatial research – if valued – should be reflected by a dedicated funding council/stream or in more radical terms, an equivalent to the US NSF be created which supports both research and teaching in a geospatial context.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

- **USA**

In terms of data supply: the USA. For example the US data catalogue available at https://www.data.gov and the Executive Order mandating Open and Machine readable data the default for US government https://obamawhitehouse.archives.gov/the-press-office/2013/05/09/executive-order-making-open-and-machine-readable-new-default-government-

Also in terms of how HE is funded via the NSF which jointly funds research and education https://www.nsf.gov/news/overviews/education/index.jsp

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Venture Geomatics Limited
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	**X**
Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

The data types being mentioned are only part of the supply chain of Geospatial data from collection and observation & monitoring, quality control and checks, processing and rendering for the end user. This Supply or Value Chain can often be lost if the tone of the term Geospatial data suggests a"GIS" environment focus. However this toolbox is but one of many aspects to Geospatial data processes and uses. The exciting opportunity here is to develop a more comprehensive and cohesive approach across the entire range of data collection & capture, geodetic densification, Planning, Environmental Impact, BIM, digital and virtual twins. The use of data analytics and database technologies that have spatial awareness can be developed so as to ensure that the "Spatial is everywhere" concept can be truly adopted across government departments, private practice and industry.
So the approach appears to cover the traditional elements however the onset of mobility and location based information tools and services is expanding and disrupting this concept especially as the users are increasingly expecting real or near-real time problem solving. This alters the spectrum of the geospatial data delivery landscape to one of an ever present availability with ease of access. As such this will require further development of data standards (formats, content, quality, interoperability) from the sensor data capture across the value chain to the end users' digital twin virtual environment supporting some form of analysis.
The Geospatial Commission has the opportunity to embrace the new technologies of AI/ML, robotics, driverless vehicles, BIM and integrate these into a strategy that does not allow the traditional skills and technologies of data capture, quality control and data delivery to be overshadowed and relegated. Geodesy, survey & measurement, EO & Remote Sensing, Engineering monitoring, GIS and Data Management are all skills and aspects of Geospatial data required in some form to

deliver the UK as no.1.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The general pressure and reduction in the number of under graduate courses offering the appropriate core Geospatial skills (Geodesy, Surveying, Photogrammetry, GIS, Geo Data Management and Cartography) is of concern and although recent initiatives such as the Geospatial Surveying apprenticeships are to be welcomed it does not go to the heart of the issue.
The Geospatial Commission could focus effort in educating and introducing geospatial curricula activities to ALL primary and secondary schools via teacher training packs, pupil learning and activity material and in developing a clear pathway for anybody interested in pursuing Geospatial as a profession. STEM courses are being encouraged and Geospatial is a component of these and the Geospatial Commission should work with DoE to develop and support school and undergraduate courses, which are often comprised of small numbers of students that require access to high value equipment, systems and technologies. The core competencies do need to be the focus and then elective elements on associated elements such as GIS, BIM, Data Analytics (as applied to Spatial), game theory, Remote Sensing, Computer Software coding can be added as desired.
Certificates should be available at all levels (GCSE, A Level, BSc etc). In this way the development of the skills can support the GovTech, unlock value and deliver a world-class Geospatial knowledge base.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Beyond the traditional geospatial core competencies (Geodesy, Surveying, Photogrammetry,Data Management and Cartography), new emerging technologies mean organizations and business sectors (as well as government) are creating a demand for Geospatial skills integrated into inter-disciplinary and related sectors. The Geospatial Commission could work to develop both a pan government environment of awareness as well as promoting and encouraging private sector and industry to develop a Geospatial Forum or Alliance in order to better represent and articulate the career prospects and opportunities. By developing a Geospatial curricula for schools and presenting a career path is a start. Thereafter the government should be encouraging the Footsie 100 and other key business groups to appoint Geospatial or Spatial Officers at board room level. Developing a Strategy over say a 10 year (or maybe to 2030) time frame would offer the chance to demonstrate commitment.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Many data sets are held in isolation or behind access restrictions. It would be beneficial to empower registered users to have a broad range of discoverable data available for download or even for some analysis. E.g. it would be good to be able to define a search area via a map on a web portal and to see and download all and any data held in relation to that area, whether from the Council, DoT, DoE, Defra, NHS etc.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

The emphasis has traditionally been on a horizontal model but more and more 3D representations are becoming a serious requirement. This is an aspect that is likely to challenge many data sets.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The success of the Catapult initiatives could offer a path to developing a Geospatial component for all Catapults – if not a Geospatial Catapult itself. Earth Observation, Remote Sensing, LIDAR and other sensor technologies are enablers to SME innovation and so it is vital that the Geospatial Commission encourages, accelerates and supports access to the sensors, access to the value chain of data and creates an environment for the government and public to be end user beneficiaries.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

The location based industries and some of the automation and transactional technologies are sectors to assess and understand through an audit of the emerging technologies and their potential roles and likely impact over time (short term impact, slow or even a long term impact,) and how they may integrate into the work flows of the future. New sensors with new data capture could be a short term benefit whilst Blockchain and Data Management might be viewed as longer (possibly slower returns) term. Technologies that can remotely monitor or capture data will be a trend that could revolutionise the geospatial industry. In a future of self-driving cars and smart cities much of the data will be collected by the routine day to day activities of vehicles and the public. Consuming and harvesting this wealth of data will be a challenge in a cybersecure GDPR world that could be really beneficial.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Technologies such as the 5G platform coupled with a general increase in the end users mobile environment of new sensors and near and real-time data provision will require a continued effort on the densification of the basic Geodetic framework as well as ensuring that the availability of data for Smart Cities and IoT can be delivered. The creation, adoption and use of digitalization techniques along with Standards for exchange and interoperability of data under a rich metadata umbrella will be vital to support future technologies.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Public Sector investment opportunities could include: 1) Data Capture and Quality 2) a: data standards compliance, b: meta data discipline and rules, c: currency of data and retention rules, 3) Web based availability of data and clustered geospatial data hosting.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the

development of, in order to support the emerging requirements for geospatial data?

A solid Geodetic framework is necessary to enable the new technologies and developments to be of value and so priority could be given to the densification of the Geodetic Network and maintaining the Geodetic Network at the highest order of accuracy and connected into a current International Terrestrial Reference Frame that realizes the International Terrestrial Reference System.
The Geospatial Commission should seed development of Indoor and Underground positioning and location methodologies. These should be encouraged and developed in order for the UK to be world no.1 in Geospatial.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Ref Q.10 above. However some aspects of the services related to the Geodetic Network could be undertaken with the private sector. Subject Matter Experts within innovative groups in private sector can be encouraged to develop technologies, for subsurface and indoor positioning. Complex challenges and shared developments to achieve solutions could be developed through the use of Geospatial clusters and regional hubs. Business sector leaders need to be encouraged partly through recognition of their contribution but also with collaborative enterprises with targets in relation to the UN Sustainable Development Goals should be introduced.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

There is still not enough cohesion for a geospatial end user when accessing data for an area. Too many silos and multiple licencing regimes create delays and friction.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

The Geospatial Commission should promulgate the concept of each and every government department having a Geospatial Officer or at least a Subject Matter Expert. Geospatial should be an integral part of any departmental strategy, website and calls for tendering, innovation and services.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Data sets relating to planning and development should be spatially enabled. The Rural Payments Agency data could be made available as could Crown Estates and effort applied to enable the underground utilities to make their data available. Web design, portals and local authority libraries could act as entry points for a spatial query and offer a visual experience of the spatial results via standard delivery services and associated data downloads. National Data Centres or Data Hubs could be explored.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still all*ow*ing for regional variations?

The Geospatial Commission could support combined industry and government seminars and workshops to raise and discuss key strategic elements and through peer groups, regional government representation and private sector industry representation create a geospatial Forum or Alliance to provide a platform for developing strategies appropriate for that region. Clustered geospatial groups in public and private sectors would develop and implement elements of these strategies leading to cross sectorial benefits.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Seed coordination and collaboration to cut costs at a policy and strategic level, aim to develop and improve efficiencies and generate a cohesive approach to unlock gains and benefits at the services level that interface to end users and the public.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Property & Land: Applications relating to transactions and assessment of taxation, concerned with land and property valuation, establishing values of Compensation and supporting Planning & development.
Infrastructure and Construction: The OSNet Geodetic Network densification, Monitoring change detection with EO and RS data, developing underground positioning and data capture, BIM & GIS with Digital Twins and Smart Cities.
Natural Resources: Supporting the development of Micro Power Grids, flood prediction, mitigation and avoidance, Electric vehicle charging points, Renewables from ocean currents, tides and waves, transportation route planning, waste and recycling.
Mobility: The planning and analysis of transportation needs, emergency response efficiency, machine learning & Robotics and smart asset tracking, digital device apps for end user groups re spatial events, risks, news.

Q18: Are there any other areas that we should look at as a priority?

The issue surrounding the existing data sets and how we might envisage these becoming available for professional and public use is offset by the potential for a growing platform of high mobility and short term currency of new data sets being captured. How and what data should be retained and managed needs to be investigated in the context of an ever increasing public data capture capability with self-determining results over-riding or bypassing rich but perhaps less dynamic database environments.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Changing markets re power generation & usage, environmental impact, BIM, Smart Cities, transportation and general geospatial Information Services and the growing awareness of the UN-SDG's, plus the expectation of access to Geospatial data will alter (increase) the demand for integrated data solutions in real (or very near real) time. Integrated and joined up collaborative developments and solutions that are cross sector will have enormous potential if the data can be accessed and shared within the innovating groups. The regulatory framework will follow and build upon the stressors and pinch points of the new methodologies but throughout the quality of the data must be a priority and our skills must be developed to ensure that the richness and value of the data is sustained.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

The UK needs to re-establish itself as the premier Geospatial academic provider through leading academic foundations and institutes delivering under-graduate and post-graduate opportunities for the UK to develop it's expertise and to offer opportunities for International relations and students. (centres do or have existed: Durham – boundaries, Nottingham – IESSG, Glasgow – Topographic, Cartography and Photogrammetry Diplomas).

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

There are numerous nations developing strong geospatial strategies and policies. In no particular order there are interesting developments in:

Canada: Spatial Strategy
France: Innovation within an EU context
Singapore: National Spatial Strategy
Japan: Regional plans
Ireland: National seabed survey across its extended EEZ with free data access
USA: Federal Geospatial plan in relation to their SDI.

Thank you for your time in completing your response to our call for evidence.

Any questions, please get in touch with the Geospatial Commission via geospatialcommission@cabinetoffice.gov.uk

National Geospatial Strategy – Call for Evidence
Vodafone response

Overview

Vodafone supports the broad statement that 'the data revolution is changing the way we see the world and the way we live our lives'.

Technologies such as AI, blockchain, cloud and edge computing are shaping how we create, access, use, move and store data about ourselves and our environment, while the connectivity of the Internet of Things and our forthcoming 5G networks are making intelligent applications available anywhere and everywhere. The increasing volumes of machine made data along with any subsequent machine created 'exhaust data' can also create interesting projects that have positive economic benefit.

Vodafone is committed to helping build a global data-driven economy. We already share insights from mobile network data with public sector bodies, often on a voluntary basis. We also encourage best practice in the sharing of machine generated non-personal data between different private sector companies in the data driven economy supply chain.

Vodafone Location Insight

Vodafone is helping delivery broader societal benefits through a number of ongoing initiatives, in particular Vodafone Location Insight. The programme provides a sophisticated way to count people and journeys derived from pseudonymised location data sourced from our mobile network.

The Welsh Government was an early adopter of this new approach and it has made use of Vodafone Location Insight to update their regional transport model and other transport projects. Surveys that involve stopping drivers on the road were not feasible for cost and safety reasons and during a 6-week study Vodafone was able to measure six million journeys within the South East Wales Region. This allowed us to build an accurate picture of how people travel around the area. All results and insights were provided to the Welsh Government as aggregate counts in a format that feeds directly into their transport models and other transport planning tools. No personally identifiable information is ever shared.

- We would advocate you watch this short, (sub 4 minute video) about our engagement with the Welsh Government: https://www.youtube.com/watch?v=fj353Sj8zdI
- Vodafone would like to confirm we are open to a similar discussion/engagement with other parts of the UK Government.

Other key use cases include:

Local Transport Studies: we have worked with leading engineering consultancies to replace legacy survey techniques with a virtual capability, an approach that is now proving far more effective than the traditional techniques. Our work with the regional government of Wales is particularly noteworthy; where we have developed advanced transport analysis techniques for use in the strategic planning of their new infrastructure programme. Outputs included travel demand matrices covering the whole country at LSOA level (Lower Super Output Areas) including information on origin, destination, mode of travel, reason for travel, time of the day and day of the week.

Airport Planning: in December 2015, the Vodafone Location Insight team worked with Citi Logik and Heathrow Airport to develop travel demand matrices covering the South of England. These matrices, provided by mode, purpose, time of the day and day of the week will be used as underlying data to develop the new transport model to be used to support the proposed Heathrow expansion and planning of the third runway and implications it might have on surface access to the airport and interactions with local communities and transport infrastructure.

The contract was awarded on a value for money basis and required our team to analyse data collected for an area covering about 15 million people. 22 billion raw events were recorded during the period, of which approximately 8 billion were identified as collected from mobile devices in movement. In total, over the course of the 60-day survey period, data from 6.5 million unique mobile devices was analysed, this corresponds to sampling about 30% of the population. The project has now been completed supported by Mott McDonald and AECOM.

A similar programme of work has also been completed for London Gatwick in conjunction with Arup. We sampled device trips from across the UK, analysing journeys to the airport by identifying trips via the various road and rail corridors surrounding it. Information was provided separating locals and workers and irregular visitors in a bid to understand how the airport impacts on the local transport infrastructure. Data will be used to provide insight for the Gatwick Airport Surface Access Strategy (ASAS).

Office for National Statistics – Administrative Data Program: for the past 18 months Vodafone Location Insight has been supporting research activity with ONS to data can be used to measure real-time commuting flows. The first phase of this project was conducted between March and April 2016 and all data outputs were made available via the ONS website to encourage feedback on the methodology and call for ideas for improvements and applications of the data for social and economic good. https://www.ons.gov.uk/methodology/methodologicalpublications/generalmethodology/onsworkingpaperseries/onsmethodologyworkingpaperseriesno8statisticalusesformobilephonedataliteraturereview

The data is being used as part of the ONS Administrative Data Program to replace existing field data surveys. The UK Office for National Statistics spends £500m conducting the census (the estimate for the US census in 2020 is $16B – probable equivalent to cost across EU 27). Big Data has the potential to reduce this cost significantly and for the first time in history our geo spatial data is enabling ONS to measure human demand on cities and public infrastructure in a statistically robust and meaningful way without the requirement to send a survey to every household.

Connected Cities: we have completed a number of projects in the UK to provide assessment of congestion in and around cities. This included analysis of multi modal movement of vehicles arriving into car parks and then transiting into the city centre within a city with severe congestion (Exeter), a port trying to alleviate congestion and improve the city centre connectivity (Liverpool) and a large city (Manchester) seeking to exploit the ideas across multiple challenges. The benefits enabled planners to

make informed decisions to enable successful transport planning for their cities, as well as highlighting popular journey routes and wider understanding of who is using the facilities. This supported the business case for future investment and ensured that budgets were being allocated to the most relevant and beneficial areas.

Industry leading data security

Vodafone has developed a comprehensive framework of technical and organisational controls to ensure that data is only processed for purposes which have been agreed with customers. In addition to navigating a complex set of horizontal and non-harmonised sector specific privacy rules (e.g. on data quality, customer permissions and data retention), Vodafone has to develop technology solution which caters for these diverse requirements.

Our services fully anonymise and aggregate data relating to movement of groups of people and transport derived from the existing mobile network infrastructure to enable data driven decision making for organisations engaged in transport planning, transport operations, smarter cities, retail planning and the built environment.

The controls cover the entire data lifecycle from notice to collection, use and deletion. All intended uses of data are relayed to customers through contextualised and layered privacy notices and required permissions are sought. Customers can manage them anytime through permissions portal. All data are pseudonymised with comprehensive algorithms prior to ingestion to analytics platform. At ingestion all data is documented and the rights and obligations related to the data carry over to analytics platform (e.g. permitted purposes, consents and retention, and are dynamically kept up to date).

All use cases are subject to Use Case Privacy and Ethics Review by experts. Non-permissioned data is filtered automatically from a given use case. Analysts must sign the Vodafone Code of Analysts Ethics prior to getting access. Our approach on Privacy by Design for Data Analytics offers true privacy protection to Vodafone customers in an industry leading manner, ensures full compliance with GDPR and ePrivacy rules.

In all of our Location Insight products, our insights are never about the individual, only the population as a whole and are always presented to our clients in an aggregate form. Vodafone never shares the actual raw data with customers of location insights. Instead, we help organisations find answers to their questions through our privacy enabled analytics service by providing anonymous insights.

[Text redacted]Vodafone Group
[Text redacted]
October 2018

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	West of England Nature Partnership
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	Cross-sector partnership

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

-

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

In the context of a degrading natural environment, plummeting biodiversity (e.g. over half our species have declined since 1970 – State of Nature report) and a changing climate, the Government has committed to improve our natural environment for the next generation. The Industrial Strategy acknowledges the importance of a healthy natural environment for a resilient economy – after all, there is no business on a dead planet. Local planning authorities have a statutory duty to protect and conserve biodiversity, which in turn relies on an effective environmental evidence system.

Commitments to achieving net gains in biodiversity and other ecosystem services are absolutely critical, and strongly welcomed. However, there are significant challenges in delivering these commitments, and holding decision makers to account, due to significant data blind spots and inconsistencies of methodology, capacity and capability across the country. This is in part how our national environmental data systems operate, with insufficient funding and leadership from

central government. Nationally, the environmental data landscape is highly fragmented. Local environmental evidence for planning and policy purposes is largely provided through Local Environmental Records Centres (of which there are around 50 across the country and which, having organically developed, adopt different data frameworks) alongside some standardised national datasets (e.g. Ordnance Survey, Natural England, Environment Agency).

However, there are few overarching standards for environmental data infrastructure and indicators at the micro level (needed to meaningfully demonstrate 'net gain'), in turn limiting the ability to compare trends across regions and over time, to apply modelling and AI to fill in data gaps, and otherwise effectively draw on learnings from elsewhere. This results in a limited understanding of our natural environment, especially at the landscape scale, as well as being a highly resource-intensive model to manage – which compromises our ability to deliver on Government's ambitions and key policy as highlighted above.

We would strongly ask that the Commission takes special consideration of how it could provide leadership in a significantly more strategic and effective approach to understanding, managing and enhancing our natural environment for the benefit of our society and economy.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

In the transition to a more effective national environmental evidence system – that focuses on moving beyond data collection to delivering the best insights and information to enhance our natural environment for the benefit of us all – the sector needs skills in GIS, remote sensing and machine learning for effective modelling, but also skills to capture and monitor the state of wildlife in the first place. In the case of the West of England, we rely on volunteers (which is an ageing demographic) for about 70% of our wildlife records.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

A particular challenge for the West of England, and shared by other Local Nature Partnerships across the country, is access to a high-quality and freely available standard land cover map (specifying, in sufficiently high granularity for meaningful planning decisions, habitats and land use). As a land cover map is the foundation for the vast majority of ecological and environmental monitoring and modelling, without a high quality and standardised base map, resulting mapping for decision

making can be inconsistent across borders, and is inefficient due to the time and resource involved in each region developing its own land cover map. Furthermore, the nature of environmental restoration is partnership working, and licences limiting data access (e.g. PSMA) can create barriers in wider stakeholders using the same evidence base.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

More centralised leadership as above

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

More centralised leadership as above

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Machine learning and remote sensing to support building a more intelligent and complete picture of our ecosystems, with the caveat that ecology is hugely complex and cannot be fully captured by modelling.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

-

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

-

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising the development of, in order to support the emerging requirements for geospatial data?

-

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-

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-

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-

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-

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-

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

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- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

-

Q18: Are there any other areas that we should look at as a priority?

As per response to Q2, we would strongly ask that the Commission takes special consideration of how it could provide leadership in a significantly more strategic and effective approach to understanding, managing and enhancing our natural environment for the benefit of our society and economy.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

As above, sufficiently effective data systems are required to enable us to restore and enhance our natural environment for our own resilience and that of future generations. As environmental evidence systems in the UK are highly fragmented, central leadership is required to enable the innovations required in turning data to information, and truly influencing decisions on the ground.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

-

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

Geospatial Commission: Call For Evidence Response Questionnaire

Please submit your completed questionnaire to:

geospatialcommission@cabinetoffice.gov.uk.

Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Wirral Council
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	**X**
Legal representative	
Local government	
Large business (over 250 staff)	
Medium business (50 to 250)	
Small business (10 to 49)	
Micro business (up to 9)	

Other - please state	

Call for evidence - three key themes

We have identified three high-level themes that could help our approach to setting a strategy which are as follows:

1. **Supporting innovation in the geospatial sector**, exploring how to secure cutting edge skills, the right access to data, and opportunities from emerging technologies for the geospatial sector itself
2. **Enhancing the UK's geospatial assets,** looking at how best to align interests, avoid duplication, and instill best practice across the whole public sector
3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

I think they are good definitions of things which are hard to define. Whilst the term geospatial would be unfamiliar to most people, alternatives would be too exclusive or misleading about what is covered.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

Formal geospatial related qualifications provide a good foundation to the wide ranging subjects of geospatial data and skills, but recruitment in GIS focuses on skills and experience. The qualifications are often done after someone has already started (knowingly or otherwise) a GIS role and are looking to develop.

I feel there are already good quality courses and resources available for those wanting to learn more about geospatial data, it is the limited numbers interested in geospatial which hinders are future geospatial capability. The sparsity of geospatial roles deters talented individuals from taking up the specialism, especially when careers as developers or analysts give so many more opportunities. If the UK is to have the future geospatial capability needed then I would encourage the commission to focus on supporting the creation of geospatial opportunities from entry level to specialist roles, across all parts of the country, in local government and private industry. Once this demand is there then the talent will follow and there is already plenty in place to support those wanting a career in this area.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Like many others who work in GIS, I got into the subject area because I did one small module on GIS during a degree. If geospatial could feature in computer science and data scientist type degrees then maybe more people might know about the subject. Even where this doesn't result in them wanting to start a career in GIS, it may help communication between future deveopers/ analysts and those working in geospatial roles.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

The ability to quickly and easily identify who owns a piece of land, which is free at the point of use, would be of imense value to public servants and greatly improve the service they can provide to the public. For example: council officers being able to quickly contact the owners of land which is being complained about. This would also be useful to those who work in the emergency services, such as fire safety officers. Whilst I understand the need for the Land Registry to protect it's revenue, if this could be centrally funded and made available to all local government I think it would improve services to the public.

Generally there can be a lack of currency, accuracy and completeness to datasets held in local government which may be important to planning future infrasture and innovation, examples might be car parking spaces, street lights, or bins. Datasets which might be nationally important to support the planning and operation of new and innovative technology might need mandatory standards to ensure it will be fit to support this.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Could definitive address data be made easier to access? If the UPRN was made easily available to the public via the ways they currently search for locations, perhaps it could be used more readily in interactions between them and the public sector.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

Sorry, run out of time…

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Q18: Are there any other areas that we should look at as a priority?

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

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Clearly title your email *'Call for evidence response'*.

About you and your organisation

Name	[Text redacted]
Organisation	Yorkshire Water Services Ltd
Job title	[Text redacted]
Address	[Text redacted]
E-mail	[Text redacted]
Telephone	[Text redacted]

Please select which of the following best describes you as a respondent:

Respondent	**Please mark with a X**
Academic	
Business representative / trade body	
Central government	
Charity or social enterprise	
Individual	
Legal representative	
Local government	
Large business (over 250 staff)	**x**
Medium business (50 to 250)	
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Other - please state	

Call for evidence - three key themes

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3. **Driving investment and productivity in geospatial applications**, asking in which wider sectors the most value lies from better exploitation and use of geospatial data, in the UK and internationally

Our questions

Q1. Is our view of the geospatial data types accurate? If not, what should be included or excluded from this?

Data types seem accurate.
Not specifically mentioned is the subsurface for which geospatial data is critical in locating and analysing resources both mineral, liquid (water and oil for example) and gas; and processes within the subsurface. Processes include geological movements, water flows, ground stability and many others.

Q2. In addition to current government policy, what are the areas of geospatial skills where the commission could best focus, to help ensure the necessary capability within the UK for the future?

The proposed skill areas outlined are excellent. What would also help is a government produced online short course/slides shown how to quickly access and use the most widely available geospatial tools available. For example, how download information from an API, how to process the data and then upload and undertake simple processing in ESRI Arc, Google maps, MapInfo etc.

Q3. What are the geospatial skills needs and gaps in your organisations, how can these be most effectively addressed, and how can careers in the sector be best promoted?

Software is difficult to access and use. It is also very expensive. These are the main barriers to use. Training is limited due to the cost and time required. We would certainly make better use of GIS if it was more easily accessible.

Careers could be promoted by linking geospatial data to existing tasks/jobs. Here it would enhance the role being undertaken by enabling better insights into the task rather than promoting geospatial data manipulation.

Q4. Are there any publicly or privately-held geospatial datasets that are currently challenging to access or use or of insufficient quality, but which you or your organisation would find valuable if these issues could be resolved? Please explain why this would be of value, and how access/quality could be improved?

Many datasets are hard to access.
The Environment Agency hold useful data, and some is available. However, it requires the user to have knowledge of API systems to access the data. Also, access is now limited to 28 days in the past for groundwater level data. This data is of immense importance for investigating, analysing, managing and using groundwater resources – a critical part of the UKs water resources.

To aid access a simple interface - probably geographical itself but not necessarily so – that allows a user to select several observation points and a date range and download the data in a simple format such as CSV or Excel would help. JASON format is good for computers and programmers, difficult for others to use.

Geophysical data collected by oil and gas companies would help in analysing geological structure and help understand groundwater flow. This data though, even old data is often kept confidential – it would be good if government could

encourage an open data approach with these organisations.

If frequently updated land use and ground elevation data are of value for lookin at changes that could represent major development or subsidence, threats to water flow or quality. This data is available but difficult to access, slow to download and needs a good knowledge of systems allow tiles to be stitched together to make useful datasets.

Use of subsurface data to generate geological models and accompanying 3D pdfs is an excellent tool for engaging with non-specialists. The ability to make the processing and manipulation of the data would reduce cost and increase access to such products.

Q5: Do you anticipate that any changes will be needed to the both address data and the wider address ecosystem, to support emerging technologies? Please provide evidence of value to support any proposed changes.

Don't tend to use 'street' address in relation to hydrogeology. However, as an organisation this is critical data and improved integration would be very useful. We could more easily find burst pipes, problems at customers addresses, locating remoted customers and generally improve our service to our customers.

Q6: How should the commission be looking to develop the UK's capability in Earth observation data, both technologically and to support an effective market?

The obvious answer is increased collaboration with ESA. The obvious problem is Brexit.
Otherwise, support to Aerospace and UK/EU GIS developers would be useful.

Q7. Which new technologies should the commission focus on to provide new opportunities to process and exploit geospatial data for economic growth?

There are developing new technologies for subsurface imaging. Tremino passive seismic is a cost effective rapid system for shallow subsurface imaging and could be rapidly enhance to provide improved understanding of the geology important for UKs water supplies and a wide range of other purposes.

Q8. How can geospatial data and applications be used to support enhanced roll-out of future technologies?

May help with remote asset survey eg with drones.

Q9: What are the options for how public sector organisations could continue to invest in maintaining and enhancing our geospatial data assets?

Make simple access to all databases stored within organisations without so much worry that the data is 100% accurate. If appropriate warnings are given the risks from the small amount of error are outweighed by the benefits of access to the information.

Q10: What areas of the underpinning geospatial infrastructure such as positioning technologies, including GPS and indoor positioning systems, and geodetic networks and frameworks to support them, should we be prioritising

the development of, in order to support the emerging requirements for geospatial data?

Improvements in GPS are the priority.

Q11: What role should the private sector have in both the development and maintenance of the underpinning infrastructure and enhancing the UK's geospatial data assets?

Private sector should be enabling suppliers to government. Government should set the policy and control the deployment of systems via national systems with as much as possible free access.

Q12. Do you face challenges when working with geospatial data from across the public sector? If so, what are they and how could value be better released? Are there any technical remedies or standards that could be adopted to improve the interoperability of geospatial data? Please provide supporting evidence of what these remedies could help to accomplish.

Data access of labyrinthine and there are no simple interfaces to access the data. The data does not have to be consistent but an easy way to see what is available then then a quick link to access it would be a major step forward. Also, list of lots of datasets, most of which are 'un-published' or inaccessible does not help.

Q13. How can the Geospatial Commission act as a more effective customer for geospatial data on behalf of the public sector?

Support open access to data.

Q14. Are there any additional geospatial datasets, from the other partner bodies or other sources, that the public sector would derive significant benefit from having access to, that might have novel and valuable use cases? What would that access look like?

No comment.

Q15: How can we best develop a single UK strategy, ensuring alignment between the individual strategies across the UK while still allwoing for regional variations?

There is a risk that one national strategy will hamstring the role out of individual datasets by generating large projects to ‘standardise’ data that is often just different.
An overarching set of guidelines with support for local, regional and organisation specific products is the preferred approach.

Q16: How can we best ensure effective local authority coordination and sharing of best practise, using location data to better deliver public services?

Encourage open access to data and provide support to LAs in developing systems.

Q17: As a result of this analysis, we are prioritising the exploration of possible initiatives in the high-value categories identified:

- **property and land**
- **infrastructure and construction**
- **mobility**
- **natural resources**
- **sales and marketing**

What are the existing or potential geospatial applications which could be scaled-up or developed in order to capture economic value? (We would particularly welcome responses from industry and other bodies engaged in these sectors.)

Capture and use of geophysical data – passive and active seismic, remote sensing (gravity/magnetic), enhance groundwater level monitoring to support water resource management.
3D geological models of the whole of UK to support groundwater flow and quality management and manage landuse to support agriculture whilst protecting water resources.

Q18: Are there any other areas that we should look at as a priority?

Some geological data is very out of date. A programme to bring all UK geology mapping into 21st century would be welcomed.

Q19: What are the main potential private and public sector innovations that will rely on the use of geospatial data to rollout, and are there corresponding regulatory challenges?

Better mapping of buried infrastructure to improve management both within and across sectors. The is primarily for water, gas and electricity distribution networks.
Better land use mapping using satellite data to improve the management of risk to water supplies from built development and changes in agriculture.

Q20: How best can we make the UK's presence in the international geospatial world more visible?

Ensure we remain integrated with European groups and systems.

Q21: Where should the UK be looking for points of comparison overseas? Who are the other international exemplars? What best practice is being modelled overseas that we can learn from?

US eg ESRI/Google
EU ESA
EU has many smaller often free to use developers whose products are excellent but need support to make them more visible. This type of development often breeds innovation with easy use and should be encouraged and supported in the UK.