UK SPACE AGENCY

Summary Report:
The Size & Health of the UK Space Industry

DECEMBER 2016

About London Economics

London Economics (LE) is a leading independent European economic consultancy, with a dedicated team of professional economists specialised in the analysis of the space sector.

From our headquarters in London, and associate offices in five other European capitals, we advise an international client base (both public and private) on economic and financial analysis, litigation support, policy development and evaluation, business strategy, and regulatory and competition policy. Our reputation for independent analysis and client-driven, world-class and academically robust economic research has been built up over 30 years.

Drawing on our solid understanding of the economics of space, expertise in economic analysis and industry knowledge, our space team has extensive experience of providing independent analysis and innovative solutions to reduce uncertainty and guide decision-makers in this most challenging of operating environments.

Our consultants are highly-qualified economists with extensive experience in applying a wide variety of best practice analytical techniques to the space sector, including:

- Insightful and accurate market analysis and demand forecasting;
- Analysis of industrial structure, competitive forces and strategy development;
- New technology adoption modelling;
- Mapping and estimation of public utility and spillover benefits;
- Opportunity prioritisation and targeting to maximise exploitation of investment options;
- Sophisticated statistical analysis (econometrics, regression);
- Literature reviews, survey questionnaires, interviews and focus groups;
- Economic and financial modelling, including: Cost-Benefit Analysis (CBA), cost effectiveness analysis, Value for Money (VfM), Multi-Criteria Analysis (MCA), impact assessment, policy evaluation, business case development, cash flow and financial sustainability analysis.

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Key findings

The 2016 edition of the ***Size and Health of the UK Space Industry*** makes a number of **notable improvements**, ensuring **greater coverage,** and **more accurate measurement** than ever before. The analysis is based on **697 UK-based space-related organisations** (243 survey responses, plus desk-based research of all organisations):

- Total income of the UK space industry grew to **£13.7 billion** in 2014/15, although growth slowed to a measured rate of **6.5%** per annum. This is equivalent to **6.5% of the global space economy** in 2014/15, with evidence of steady progress towards the 10% ambition (if currency fluctuations are stripped out).
- The **upstream** segment is larger than previous years at **£1.7 billion**, though the **downstream** segment remains dominant at **£12.0 billion** in 2014/15. **Space Applications** is by far the largest segment (**74%** of total income), driven by Direct-To-Home broadcasting (£7.1 billion), followed by Space Operations (**15%**), Space Manufacturing (**8%**) and Ancillary Services (**3%**).
- The industry is concentrated, with **19** organisations accounting for **89%** of total industry income.
- Aggregating across all activities, **Broadcasting** dominates (**56%** of total UK space industry income) followed by Communications (**20%**) and Position, Navigation and Timing (**12%**). There is positive evidence of diversification, as the income share of Broadcasting is down from 63% in 2012/13.
- The industry is commercially-focused, generating just **13.9%** of its income from the **public sector** (Space Agencies **3.1%**, Government agencies **10.8%**) – low compared to the global average (24%) – with sales to consumers (**54%)** and businesses (**32%**) dominating.
- Exports grew to £5.0 billion in 2014/15, or **36.4%** of total income (up from 31.0% in 2012/13) – almost **30% higher** than the UK economy. The share increases to **69%** if DTH is filtered out (60% in 2012/13). The most important export market is the **Rest of Europe**, increasing to **49%** of total exports.
- The industry directly contributed **£5.1 billion** Gross Value-Added to UK economic output (**0.27%** of total UK GDP), and a total of **£10.0 billion** (including effects on the supply chain) in 2014/15.
- Total direct employment in the UK space industry increased at a rate of **6.0%** per annum to **38,522** jobs in 2014/15 (0.12% of the total UK workforce), and a total employment supported of **113,866**.
- All thirteen UK regions are home to headquarters of space organisations, though industrial sites, and thus employment, are **concentrated in London, South East and East of England, and Scotland**.
- The UK space industry's labour productivity (calculated as average GVA per employee) stands at **£133,233 – 2.7 times the UK's average labour productivity** in 2014**.**
- The space industry workforce is **exceptionally highly-skilled**, with **3 in 4** employees holding at least a primary degree – **higher than any sector covered by ONS Census data for England and Wales.**
- The industry is R&D intensive – with **8.1%** of direct GVA invested in R&D – **over 6.5 times higher than the UK average**. R&D expenditure in 2014/15 stood at **£415m** or about **3.0%** of total income in the industry, with the Space Manufacturing the most R&D-intensive segment.
- Economic uncertainty is the most prevalent barrier for the largest number of respondents, with **43%** of respondents selecting economic uncertainty (two-thirds of responses came after the EU referendum). However, there is encouraging optimism with respect to near-term **income growth** (7 in 10 respondents) and **job growth** (6 in 10 respondents) – especially from larger space organisations.
- It is estimated that wider UK industrial activities representing **over £250 billion of UK non-financial business economy GDP (13.8%)** is **supported by satellite services** as follows (not mutually exclusive):
  - **GNSS (positioning, navigation and timing)** satellite services support **£206 billion** of GDP (11.3%).
  - **Meteorological** satellite services support **£169 billion** of GDP (9.3%).
  - **Telecommunication** satellite services support **£117 billion** of GDP (6.4%).
  - **Earth Observation** satellite services support **£89 billion** of GDP (4.9%).

Summary of findings

Introduction

The UK Space Agency ('the Agency') is responsible for all strategic decisions on the UK civil space programme and provides a clear, single voice for UK space ambitions. Every two years, the Agency studies all organisations in the UK who supply and/or make use of space or satellite services – from upstream manufacturing right through to downstream satellite-enabled applications, including both commercial and non-commercial activities (e.g. fundamental research, space science).

The series of studies, titled the ***Size and Health of the UK Space Industry***, represents **the definitive source of information on the UK space sector**. As such, it is used by the Agency to track growth and developments in the industry, identifying emerging trends and any limiting constraints on performance. These insights play an important role in shaping UK space policy and targeting support to industry in reaching the ambition of attaining 10% of the global space-enabled market by 2030.

The Agency again commissioned London Economics to conduct the study, with this latest edition covering the years 2013/14 and 2014/15. By supplementing inputs from an online survey with *significant* secondary research and analysis, and adopting thought-leading frameworks and best practice techniques to measure the space economy, this edition gives the most **comprehensive, progressive and accurate overview** to date of the size, performance and characteristics of organisations engaged in space-related activity in the UK. This report summarises the findings of the 2016 edition.

Approach

Striking a balance between the two contrasting aims of historical consistency and progressive evolution, the approach was redesigned to reflect the modern space economy and our enhanced understanding, knowledge, and ability to measure this (relatively) young UK sector.

As in previous years, a survey of industry was administered as an online questionnaire, but it is important to note that the study does not solely rely on the survey. Rather, the approach employs a **combination of primary and secondary research methods** to deliver comprehensive coverage (to the best of our, Agency and industry representatives' knowledge) of the UK space industry.

This edition makes a number of **notable improvements** on previous editions, ensuring **greater coverage** and **more accurate measurement** of the sector than ever before:

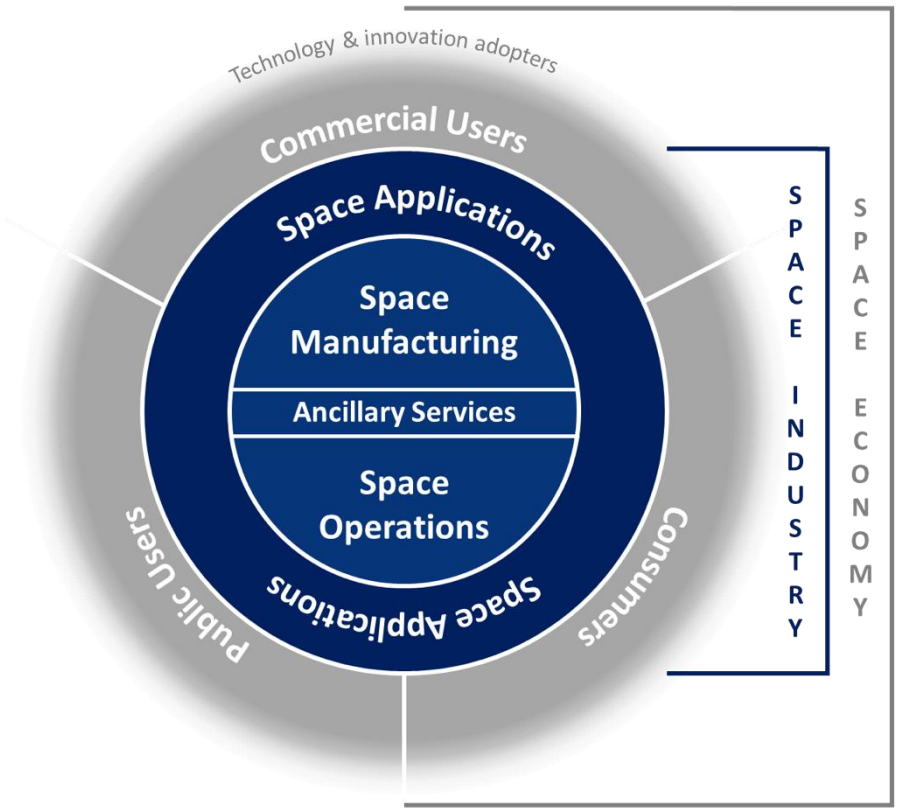
- An evolution of the **segmentation** beyond – but yet still consistent with – the historic upstream/downstream dichotomy;
- Updated **identification** search of space-related organisations in the UK, with a special effort to ensure better representation of universities, research institutions, and organisations in Scotland, Wales, Northern Ireland and other regional clusters – the findings are based on **697 UK-based space-related organisations**;
- The 2016 **questionnaire** was streamlined and refined substantially with the aim of reducing respondent burden, facilitating participation and improving accuracy;
- A doubling of survey responses compared to the 2014 edition – an achieved total of **responses from 243 organisations**, including some consolidations since 2014;
- Substantially expanded programme of **secondary research** to cover all space-related organisations in the UK – survey responses have been cross-checked and supplemented by

desk-based research (statutory annual reports on Companies House, Bureau van Dijk's Orbis financial database, London Economics' proprietary databases and knowledge of the space industry, etc.) of **454 non-respondent organisations**;

- Numerous **methodological refinements** – the questionnaire requested point estimates of income and employment breakdowns rather than ranges (as used in previous editions), improved isolation of UK-specific activity, and reduced reliance on group-wise interpolation as a result of additional secondary research;
- **Additional regional analysis** of the UK industry, building off the improved regional identification; and
- A novel consultation-based approach to gauging the **use of space and satellite services** to enable estimation of the value of wider UK industrial output supported by satellite services.

Building on advances in the *Size and Health* 2014 edition and *The Case for Space 2015,* this 2016 edition migrates from the traditional **space industry** focus to a progressive **space economy** scope. This extension is important for comprehensive coverage of the full range of space-related activities in the UK, consistent with international best practice[1] – as illustrated in the figure below.

Segmentation of the UK space economy



Source: London Economics

[1] For example: OECD's *The Space Economy at a Glance* series, and The Space Foundation's *The Space Report* series – both of which were used as reference estimates in the setting of the Space IGS ambitions.

The **'space industry'** is defined to include all organisations (or part thereof) that are engaged in any space-related activity. It comprises both:

- **Commercial organisations** (i.e. businesses, companies, firms) that earn revenue from the manufacture, launch and operation of satellites/spacecraft, and from utilisation of the signals and data supplied by satellites/spacecraft to develop value-added applications; and
- **Non-commercial organisations** (e.g. universities, research institutes) that secure funding to contribute space-specific research and expertise throughout the industry supply chain, often in partnership with commercial organisations.

Reflecting this diversity, this edition refers to '**Income**' rather than 'Turnover' (used in previous editions). Non-commercial income includes grant funding, core funding, research funding, tuition fees, departmental expenditures, operating budgets, amongst other sources.

A **'space-related activity'** is defined to be any one (or more) of the following activities:

- **Space Manufacturing: Design and/or manufacture of space equipment and subsystems**

  Including: launch vehicles and subsystems, satellites/payloads/spacecraft and subsystems, ground segment systems and equipment (control centres and telemetry), suppliers of materials and components, scientific and engineering support, fundamental and applied research.
- **Space Operations: Launch and/or operation of satellites and/or spacecraft**

  Including: launch services, launch brokerage services, proprietary satellite operation (incl. sale/lease of capacity), third-party ground segment operation, ground station networks.
- **Space Applications: Applications of satellite signals and data**

  Including: Direct-To-Home (DTH) broadcasting, fixed and mobile satellite communications services (incl. VSAT), location-based signal and connectivity service providers, supply of user devices and equipment, processors of satellite data, applications relying on embedded satellite signals (e.g. GPS devices and location based services) and/or data (e.g. meteorology, commercial GIS software and geospatial products).
- **Ancillary Services: Specialised support services**

  Including: launch and satellite insurance (incl. brokerage) services, financial and legal services, software and IT services, market research and consultancy services, business incubation and development, policymaking, regulation and oversight.

The importance of space and satellite services in the UK does not end with the activities of the space industry. Rather, a wide range of organisations engaged in non-space activities across the economy (and individuals across society) are **supported by satellite services** – termed **'users'**. As testament to this fact, 'space' is designated as a critical element of the UK's national infrastructure.[2] For the purposes of this study,[3] (commercial) users are defined as 'organisations in **UK industries supported**

[2] The UK's national infrastructure is defined as: "Those critical elements of infrastructure (namely assets, facilities, systems, networks or processes and the essential workers that operate and facilitate them), the loss or compromise of which could result in: a) major detrimental impact on the availability, integrity or delivery of essential services – including those services, whose integrity, if compromised, could result in significant loss of life or casualties – taking into account significant economic or social impacts; and/or b) significant impact on national security, national defence, or the functioning of the state". Source: Centre for the Protection of National Infrastructure http://www.cpni.gov.uk/about/cni/

[3] The focus of this study is on the space industry and commercial users of space and satellite services, though users of space extend to non-commercial domains: public users (e.g. HM Government) and consumers (i.e. general public).

by satellite services for whom, if satellites are turned off, their business model would be severely disrupted even after an appropriate adjustment time has passed'.

Caveats and limitations

Though the research has been conducted by a team of independent professional economists with specialist knowledge of the space sector, using best practice and best judgement to calculate the most robust and fair estimates, the following caveats apply to the analysis:

- **Trend analysis:** Although we are confident that this edition's estimates are the most accurate and robust to date, the estimates and measured growth rates reflect the net effect of methodological improvements that were adopted for this edition of the study.
- **Unidentified omissions:** Despite best efforts, some organisations with space-related activities based in the UK are likely to have been missed, but any omissions should be on the smaller end of the size spectrum and would not have a meaningful impact on estimates.
- **Measurement error uncertainty:** The analysis employs estimation and approximation techniques such that the true coverage of the analysis and the measurement error associated with survey respondent data cannot be estimated.
- **Streamlined survey:** The benefits of streamlining in terms of reduced respondent burden, increased participation and improved accuracy, come at the cost of losing some depth and breadth of the analysis – although this does not affect any of the headline outputs.
- **Exchange rate fluctuations:** The monetary values quoted in this report are expressed in GBP. Over the study period (2013/14 – 2014/15), there has been an appreciation in the GBP against the major currencies (EUR, USD, JPY, CHF). Since the UK space industry supply chain sources inputs from overseas (foreign currency prices converted to GBP) and exports goods/services for sale abroad (GBP prices converted to foreign currency), the pattern of income over time therefore reflects both an actual change in sale volumes and fluctuations in currency values over that time.
- **BREXIT out of scope:** Although the survey participation period did include the UK EU membership referendum (23 June 2016), the period of analysis (2013/14 – 2014/15) does not. Therefore, the results do not include any (meaningful) effect concerning BREXIT.

Note: All figures presented are in constant 2014/15 prices. All growth rates are in real terms (inflation-adjusted), all average growth rates are compound annual growth rates (CAGR).

Size of the UK space industry

Income

Total income of the UK space industry continued to grow over the two-year period, to **£13.7 billion** in 2014/15.

In terms of the traditional segmentation, the **upstream** segment is notably larger than previous years at **£1.7 billion**, but the **downstream** segment remains dominant – at **£12.0 billion** in 2014/15, accounting for 88% of total industry. Excluding Direct-To-Home broadcasting (DTH) would reduce the overall income of the space industry to **£6.6bn**, with downstream accounting for three-quarters of income.

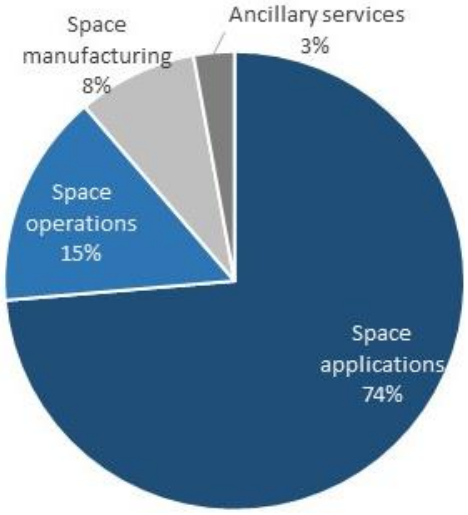
Analysing the space industry income by segment reveals substantial differences in size. **At £10.1 billion**, **Space Applications is by far the largest segment**, accounting for **73.7%** of income –

dominated by DTH satellite television provision, which makes up the majority of income in this segment and **52.0%** of total space income (down from 53.0% in 2012/13). Space Operations is the second largest segment (**15.1%**) with Space Manufacturing (**8.4%**) in third and Ancillary Services accounting for only **2.9%.** Space Operations is dominated by proprietary satellite services, accounting for **73.1%** of income in this segment and **11.0%** of total space income. The manufacture of satellites, payloads, spacecraft and subsystems is the largest Space Manufacturing activity in the UK, accounting for almost half of total manufacturing income and **4.1%** of total space income.

UK space industry income by segment, 2014/15

Segment	2014/15
	£m
Space Applications	10,092
Space Operations	2,066
Space Manufacturing	1,151
Ancillary Services	392
Total	**13,702**

Source: London Economics analysis

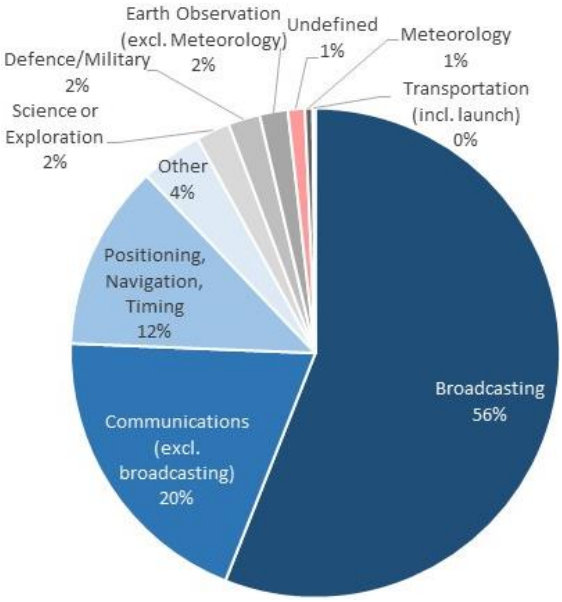


Looking across all segments, **Broadcasting** dominates with a **total income of £7.7bn**, or **56.0%** of total income in 2014/15 – down from 63.3% in 2012/13, suggesting positive diversification in the industry. Together with Communications (**19.6%**) and Position, Navigation and Timing (**12.2%**), they account for **87.9%** of total space industry income.

UK space industry income by capability, 2014/15

Capability	2014/15
	£m
Broadcasting	7,672
Communications (excl. broadcasting)	2,690
Positioning, Navigation, Timing	1,681
Other	563
Science or Exploration	305
Defence/Military	288
Earth Observation (excl. Meteorology)	256
Meteorology	69
Transportation (incl. launch)	23
Undefined	154
Total	**13,702**

Source: London Economics analysis



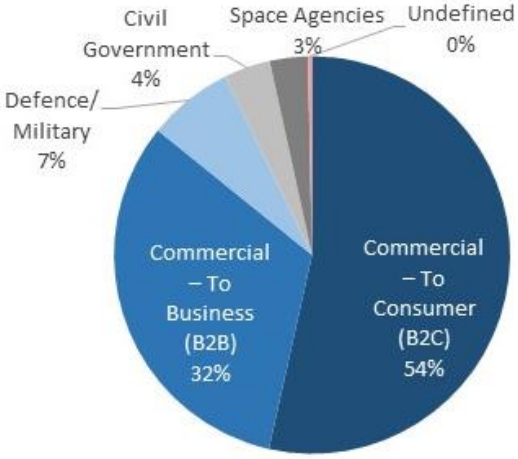
The industry is commercially-focused, generating just **13.9%** of its income from the **public sector** (Space Agencies **3.1%**, dominated by ESA; and Government agencies **10.8%**, of which **3.8%** civil and

7.0% military), which is low compared to the global average (24%[4]). In the 2014/15 financial year, business-to-consumer (B2C) sales accounted for **53.5%** of total sales from the space industry, with sales to businesses (B2B) representing **32.3%** of total sales. These proportions have remained almost constant since 2004/05, and total income generated from B2C and B2B customers has increased from **£10.4 billion** to **£11.8 billion** in 2014/15, which equates to a real compound annual growth rate of **13.0%**.

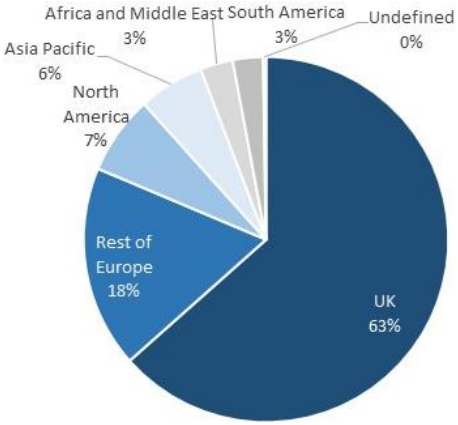
UK space industry income by customer type, 2014/15

Customer	2014/15 £m
Commercial – To Consumer (B2C)	7,332
Commercial – To Business (B2B)	4,423
Defence/Military	954
Other Civil Government	368
European Space Agency (ESA)	351
Research/Science Funding Bodies	89
European Commission	65
Other Space Agency	40
UK Space Agency	36
Undefined	44
Total	**13,702**

Source: London Economics analysis



The UK space industry has enjoyed **success in exports and now generates 36.4%** (up from 31.0% in 2012/13) of income abroad (£5.0bn).[5] At **36.4%**, the UK space industry's export share is almost **30% higher** than the export share of the UK economy as a whole (**28.1%**[6]). The picture improves further if DTH broadcasting – which has a strong domestic market focus (only modest exports to Ireland[7]) – is filtered out. Indeed, **the UK space industry excluding DTH has an increased export share of 69% in 2014/15** (compared with 60% in 2012/13).



The most important export market for the UK space industry is the **Rest of Europe** (includes European Space Agency, European Commission, and European governments, businesses and consumers) – which has gained importance since 2012/13, now representing 17.9%[8] of total income (compared to 12.7% in 2012/13) and 49% of total exports. In fact, the domestic market and the Rest of Europe are similarly sized (at 31% and 30% of total income) for non-DTH activities. The Americas continue to represent the third largest market, growing by **over a quarter** between 2012/13 and 2014/15.

[4] The Space Foundation (2016) *The Space Report 2016*. Overview of the report is freely available online at: http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2016_OVERVIEW.pdf

[5] By definition, goods and services sold to ESA are an export as the ownership of goods or intellectual property changes hands from a UK entity to an entity that is based in a foreign country and which is not majority-controlled by UK interests.

[6] Trade in goods and services – UK export % of GDP, 2014. Source: OECD (2016). 'Trade in goods and services (indicator)' from *OECD National Accounts at a Glance*. Available at: https://data.oecd.org/trade/trade-in-goods-and-services.htm

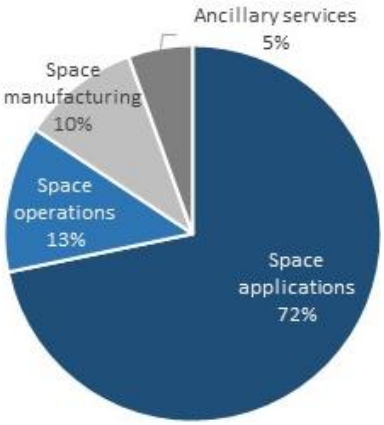
[7] Sky Italia and Sky Deutschland were acquired by Sky PLC during the analysis period, but had not been consolidated as of the latest annual report. Sky's activities in Continental Europe therefore remain outside the scope of the present analysis.

[8] This includes ESA and other customers from the Rest of Europe.

Contribution to GDP

A key impact of any sector, region, or firm on the economy is its contribution to the output, or Gross Domestic Product (GDP) of the country, approximated by Gross Value-Added (GVA). In 2014/15, the UK space industry is estimated to have directly contributed **£5.1 billion** Gross Value Added (in current prices) to UK economic output – equivalent to **0.27%** of total UK GDP.

As was the case for income, the **downstream segment** generated the majority **(£4.4 billion or 86.3%)** of total UK space industry Gross Value Added in 2014/15. **The majority of UK space GVA is generated in the Space Applications segment with 71.6%**, slightly less than the **73.7%** of income accounted for by the segment, but as for income, led by Direct-To-Home broadcasting (contributing **48.6%**). At **10.1%**, Space Manufacturing accounts for a higher share of GVA than income (**8.4%**). At **12.7%** Space Operations accounts for a smaller share of GVA than income (**15.1%**). Conversely, Ancillary Services contribute **5.5%** of space industry GVA (compared to **2.9%** of income).



Employment

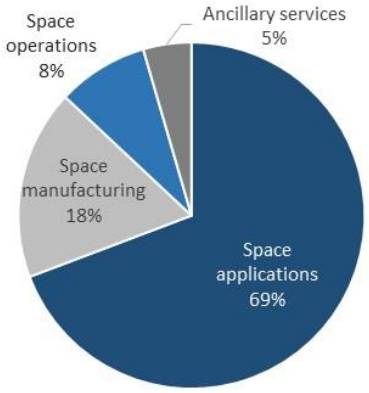
Employment is another key measure of impact on an economy. Total employment (headcount) in the UK space industry increased from **34,310** jobs supported in 2012/13 to **38,522** jobs in 2014/15 – equivalent to 0.12% of the total UK workforce. The total breaks down to **8,575** jobs supported in the **upstream**, segment and **29,947** jobs supported **downstream** in 2014/15.

Unsurprisingly, the Space Applications segment also dominates employment, accounting for **69.3%** of total space industry employment, of which DTH broadcasting is **52.3%** of the total. Space Manufacturing employs a greater number of staff than Space Operations (**17.8%** and **8.4%**, respectively), with Ancillary Services making up a small but important workforce (**4.5%**).

UK space industry employment by segment, 2014/15

Segment	2014/15
	# of employees
Space Applications	26,711
Space Manufacturing	6,841
Space Operations	3,235
Ancillary Services	1,735
Total	**38,522**

Source: London Economics analysis



Labour productivity and qualifications

The UK space industry's labour productivity (calculated as average GVA per employee) stands at **£133,233 – 2.7 times the UK's average labour productivity** in 2014 (**£49,815).**

Labour productivity varies across value chain activities: Space Manufacturing (£75,950); Space Operations (£199,424); Space Applications (£137,832); Ancillary Services (£163,482). However,

whilst a useful and informative metric, labour productivity does not tell the whole story. Activities that rely on a large capital stock to deliver goods and services may present large labour productivity estimates as fewer employees are required. Similarly, some activities such as fundamental and applied research and policymaking, regulation and oversight enable creation of value elsewhere in the value chain.

This high level of labour productivity is a reflection of the highly-skilled workforce of the UK space industry. Overall, the space industry employs **an exceptionally skilled labour force**. The survey responses indicate that the majority of employees have undertaken university education, with **74%** of employees in the overall industry possessing at least a bachelor degree. **15%** of employees instead hold vocational qualifications (i.e. a Higher National Certificate (HNC) or Higher National Diploma (HND)), and the remaining **11%** are in possession of other qualifications, including space-specific diploma gained in ESA or other settings. As measured by the 'share of employees holding a higher degree, first degree or HNC/HND and equivalent qualifications', the **average qualification level of space industry employees is higher than any sector covered by ONS Census data for England and Wales** – and this applies for the space industry as a whole, and all of the four value chain segments.

Research and Development (R&D)

Investments in research and development generate new knowledge, products and processes, allowing firms to use the inputs available to them more efficiently and to supply improved products or services to the economy.

R&D expenditure in 2014/15 stood at **£415m** or about **3.0%** of total income in the industry – lower than in recent years, representing only 90% of the 2012/13 total – although the R&D intensity varies widely by segment. In monetary terms, the Space Applications segment has the largest R&D activity at **£207m**, followed by Space Manufacturing at **£164m**. However, the Space Manufacturing segment is the most R&D-intensive, reinvesting **14.3%** of income on R&D. Space Operations and Space Applications are lower on R&D intensity at **1.0%** and **2.1%** of income invested in R&D, respectively. Ancillary Services are above the average, reinvesting **5.8%** of income on R&D.

This pattern highlights a key feature of the space industry: capability developed in the R&D-intensive upstream is commercialised by downstream organisations. Space Manufacturing organisations maintain their R&D intensity by winning more external funding, with **62%** of R&D funding sourced externally (e.g. research grants). Organisations in other segments are more reliant on internal R&D funding (where the organisation undertaking the R&D pays itself), with each raising a lower **12%-38%** of R&D funding externally. Without the R&D intense space manufacturing segment, there would be no space applications, so public schemes are designed to transfer income from the lucrative downstream activities to the enabling upstream activities.

With the equivalent of **8.1%** of direct GVA in the industry invested in R&D – **over 6.5 times higher than the UK average** of 1.2% – the UK space industry compares favourably to key economic sectors such as chemicals and computer, electronic and optical products (**7.5%** and **7.6%**, respectively). However, the pharmaceutical sector invests relatively more than the space sector, at **29.4%** of GVA.

Health of the UK space industry

Growth: Income

Total income of the UK space industry continued to grow over the two-year period, although the rate of growth slowed to a measured rate of **6.5%** per annum – from an average of **8.5%**[9] per annum between 1999/2000 and 2012/13, and more recently **7.3%** between 2010/11 and 2012/13.

The latest year (2014/15) proved particularly challenging for the industry (year-on-year growth of just **1.7%**) to the point that it was the first year since before the turn of the millennium that space industry income failed to outpace growth in the wider UK economy (2.2%)[10]. However, this was a tough year for the global space industry more generally, which recorded a slight decline (influenced by currency fluctuations) between 2014 and 2015.[11]

To repeat the earlier **caveat**, although we are confident that this edition's estimates are the most accurate and robust to date, the estimates and measured growth rates reflect the net effect of methodological improvements adopted for this edition of the study. Consequently, there are complexities with identifying 'true growth' meaning that any change is not a pure performance effect. In reality, the **like-for-like underlying 'true' growth rate over the two-year period of analysis is likely to be lower than the measured rate.**

Space industry income, 2009/10 – 2014/15

	Current prices, £m	2014-15 prices, £m	Real growth
2009/10	8,334	9,425	8.0%
2010/11	9,188	10,040	6.5%
2011/12	11,087	11,741	16.9%
2012/13	11,848	12,091	3.0%
2013/14	**13,347**	**13,469**	**11.4%**
2014/15	**13,702**	**13,702**	**1.7%**
*2015/16**	*14,241*	*13,875*	*1.3%*

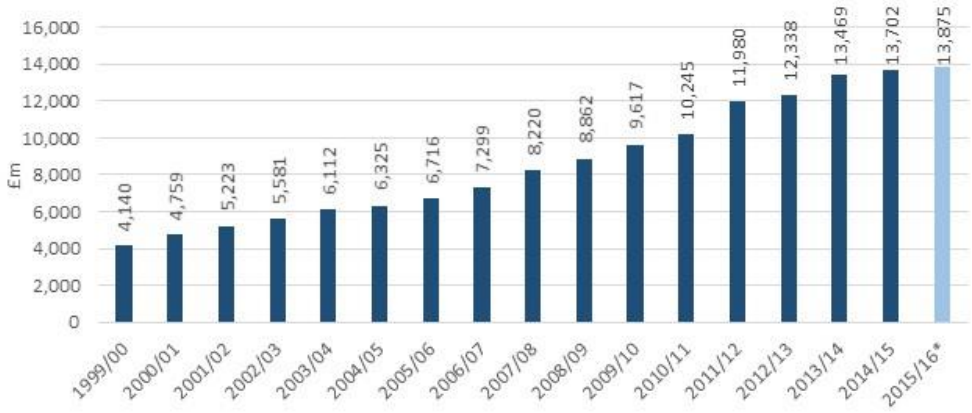
Note: 2015/16 forecast based on survey responses and analysis of annual accounts

Source: London Economics analysis

Over the longer term the UK space industry has more than trebled in real terms since the turn of the millennium, growing at an average rate of **8.1% per annum since 1999/00**.

[9] London Economics (2015). *The Case for Space 2015*.
[10] Office for National Statistics (2016). https://www.ons.gov.uk/economy/grossdomesticproductgdp
[11] The Space Foundation (2016).

Space industry income, 1999/00 – 2014/15



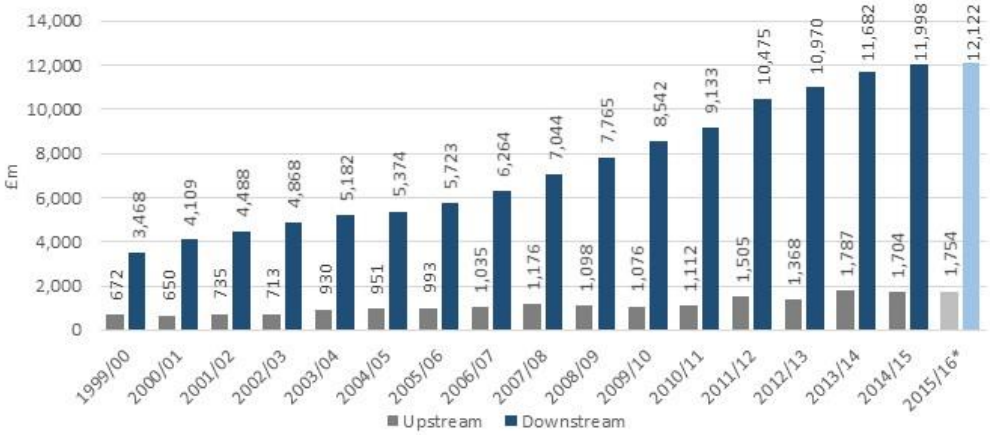
Note: 2015/16 forecasted based on survey respondents' forecasts and analysis of annual reports.

Source: London Economics analysis

This development was largely driven by strong and continuous growth in the downstream segment (with a real compound annual growth rate of **8.8%**), resulting in total income in the downstream segment in 2014/15 of **£12.0 billion**. In contrast, developments in the upstream segment have historically been more varied, exhibiting compound annual growth of **6.5%** since the 1999/2000 financial year, and bringing total upstream income to **£1.7 billion** in 2014/15. Though the upstream segment contains almost 300 organisations in the 2014/15 financial year, it is dominated by large players whose specific business environments and developments can offset growth among other firms in the segment.

The downstream segment has enjoyed stable growth over the period, with income increasing by **11.6%** in real terms since 2012/13. **Although the upstream segment has grown notably** (driven to a large extent by increased identification), **the downstream segment remains dominant.**

UK downstream and upstream space industry income 1999/2000-2014/15



Note: 2015/16 forecasted based on survey respondents' forecasts and analysis of annual reports.

Source: London Economics analysis

Growth: Employment

Total employment in the UK space industry reached more than 38,500 in 2014/15 following strong growth at a rate of **6.0%** per annum since 2012/13 – more than three times greater than the employment growth rate in the overall UK economy (CAGR of **1.8%**)[12].

Employment in the downstream segment has enjoyed steady average employment growth of **5.4%** per year since 2012/13, hence increasing to **29,947** jobs supported in 2014/15. On average, upstream segment employment has increased by a compound average growth rate of **7.7%** per year since 2012/13.

DTH broadcasting remains the largest employer, estimated to account for **52%** of space industry employment, and its employment growth between 2012/13 and 2014/15 has accounted for more than half of the industry employment increase.

Space industry employment 2009/10 – 2015/16

	Upstream		Downstream		Total	
	Employees	Growth (% year)	Employees	Growth (% year)	Employees	Growth (% year)
2009/10	7,106	-2.7%	21,889	24.5%	28,995	16.5%
2010/11	7,117	0.2%	21,825	-0.3%	28,942	-0.2%
2011/12	7,406	4.1%	24,618	12.8%	32,024	10.6%
2012/13	7,391	-0.2%	26,491	7.6%	33,882	5.8%
2013/14	**8,907**	**20.5%**	**28,484**	**7.5%**	**37,391**	**10.4%**
2014/15	**8,575**	**-3.7%**	**29,947**	**5.1%**	**38,522**	**3.0%**
*2015/16**	*8,879*	*3.5%*	*30,976*	*3.4%*	*39,855*	*3.5%*

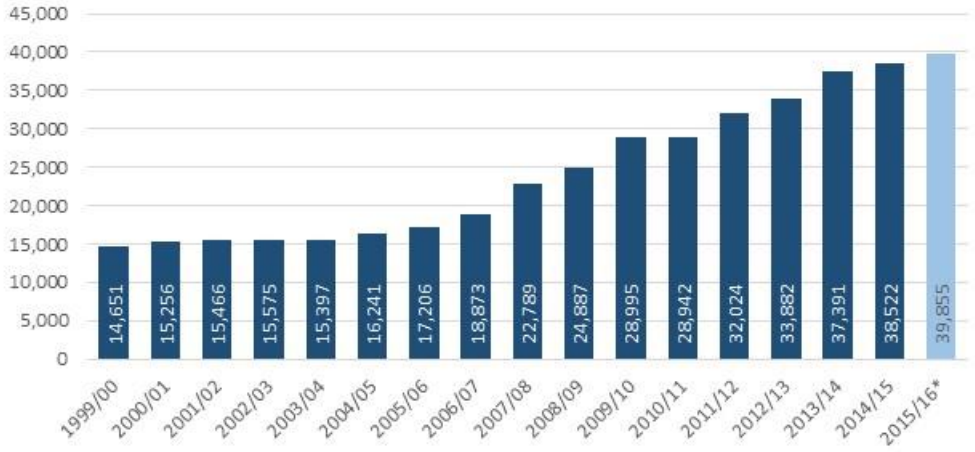
Note: 2015/16 forecasted based on survey respondents' forecasts and analysis of annual reports.

Source: London Economics analysis

The figure below presents space employment since 1999/2000. Employment has grown strongly throughout the period at a compound annual growth rate of **6.7%** (and **5.8%** in the last five years). Except for small contractions in 2003/04 and 2010/11, space industry employment has increased every year since 1999/00 and continued during the financial crisis.

[12] Office for National Statistics (2016). Estimates are based on the difference in employment levels for the UK population aged 16 and older measured in December in each calendar year.

Direct employment supported by the UK space industry, 1999/00 – 2015/16

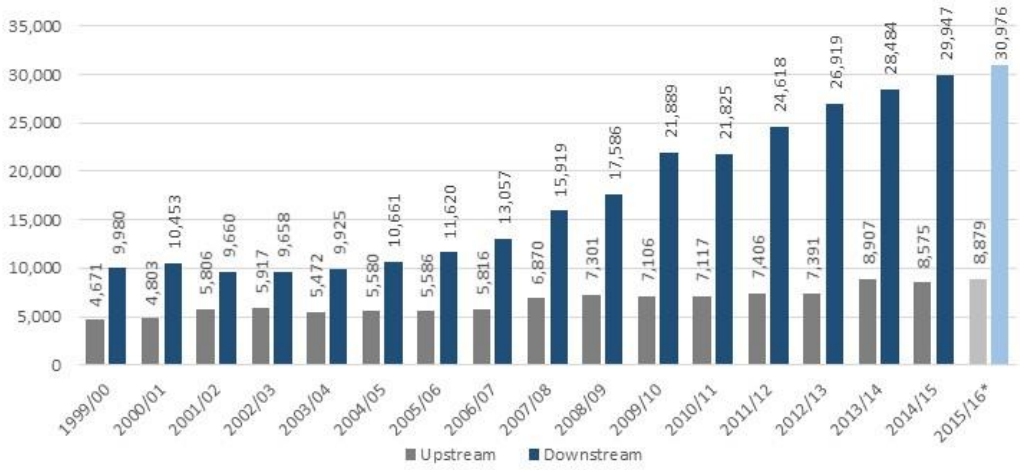


Note: 2015/16 forecasted based on survey respondents' forecasts and analysis of annual reports.

Source: London Economics analysis

Apart from a small drop in 2010/11, downstream has grown continuously since 2003/04. Upstream on the other hand exhibits more variance. The UK space industry's upstream segment is heavily concentrated, with business changes for a small number of large companies determining the general development within the segment.

Space industry employment, 1999/00 – 2015/16



Note: 2015/16 forecast based on survey responses and analysis of annual accounts

Source: London Economics analysis

Growth: GVA

Gross Value Added dropped in real terms by **-0.3%** between 2012/13 and 2014/15 to **£5.1 billion** – a real annual change of **-0.1%**. This decrease was driven by a fall in downstream segment at a real compound annual growth rate of **-2.3%** over the 2 years. In contrast, upstream segment GVA has experienced significant growth (both in nominal and real terms) since 2012/13, exhibiting a real compound growth rate of **18.0%**.

Direct Gross Value-Added of the UK space industry, 2009/10 - 2014/15

Year	£m, current prices	£m, 2014/15 prices	Real growth
2009/10	3,789	4,164	0.5%
2010/11	4,130	4,377	5.1%
2011/12	4,597	4,780	9.2%
2012/13	5,044	5,147	7.7%
2013/14	**5,020**	**5,066**	**-1.6%**
2014/15	**5,132**	**5,132**	**1.3%**
*2015/16**	*5,343*	*5,205*	*1.4%*

Note: 2015/16 forecasted based on survey respondents' forecasts and analysis of annual reports.

Source: London Economics analysis

The UK space industry accounts for an increasingly larger share of UK GDP, estimated to be **0.27%** in 2014/15.

Industry composition

The UK space industry covers the full spectrum of organisation size (defined with respect to space-related income only, and not total organisation income), from start-ups with very little space-related income to multinational conglomerates turning over tens of millions. However, the space industry is dominated by large organisations, with just **19** organisations accountable for **88.7%** of total space-related income in the industry, and **600** organisations accountable for just **3.5%**. **Only 97 organisations generate space income in excess of £5m.**

Barriers to growth

Although the survey window period did straddle the UK EU membership referendum (23 June 2016), more than two-thirds of respondents did come post-announcement of the referendum. Despite this fact, the overall tone of respondents was positive for the next 3 years. As might have been expected, however, a number of survey respondents cited uncertainty resulting from '**BREXIT'** and the UK's future role in EU-managed space programmes.

Economic uncertainty is the most prevalent barrier for the largest number of respondents, with **43.3%** of respondents selecting economic uncertainty. Around a third of respondents indicate obtaining finance, cash flow, competition and recruiting staff as important barriers to growth.

The data indicate that firms with significant space income have very limited problems obtaining finance (only **7.5%** of respondents if weighting by income) and cash flow (**15.1%**), but tend to be particularly worried about economic uncertainty (**77.9%**) and competition in the market (**84.0%**). Smaller space organisations experience problems obtaining finance and cash flow issues.

Expected performance over the next 3 years

Survey respondents indicated an encouraging optimism with respect to near-term **income growth** – especially those from larger space organisations. Over the coming three years, the UK space industry is expected to outperform the economy as a whole – with **70%** of respondents expecting income growth, of which 41% expect more than 10% higher than the previous three years.

The UK space workforce is expected to grow faster than total employment in the UK workforce, with **57%** of respondents predicting **job growth** and a further **36%** expecting their workforce to remain largely unchanged.

The survey respondents indicate a strongly positive story on **export growth** over the coming three years. Whilst **40%** expect a continuation of the current export sales level, **54%** of respondents predict slight (22%) or much higher (32%) growth in export sales, with smaller organisations particularly optimistic on export sales growth.

As with exports, the mode response (47%) sees a continuation of current R&D expenditure levels, with most of the rest (46%) of respondents forecasting an uplift in R&D investment, split evenly between slightly higher (23%) and much higher (23%). Again smaller organisations are more optimistic with respect to future R&D expenditure, than larger space organisations.

The strongest optimism of all was reserved for total investment over the next three years, with **55%** of respondents expect total investment to be either slightly (25%) or much higher (29%) than the previous three years.

Regional distribution of the UK space industry

As with the 2014 edition, the 2016 survey asked respondents to explicitly identify the regional composition of their UK workforce by location and postcode. However, the breakdown of income continues to be based on Head Office (or headquarters) location owing to the inherent complementarity of activities at different sites, making a more granular approach infeasible.

Thanks to a special effort made to improve regional representation from organisations in Scotland, Wales and Northern Ireland, this edition presents the most comprehensive regional analysis to date of the UK space industry. Improvements in coverage and measurement have also changed results for some regions compared to the 2014 edition.

The regional distribution is presented across the twelve 'NUTS1'[13] regions of the UK – the nine regions of England and the three country-level regions of Scotland, Wales and Northern Ireland – plus the British Crown Dependencies.

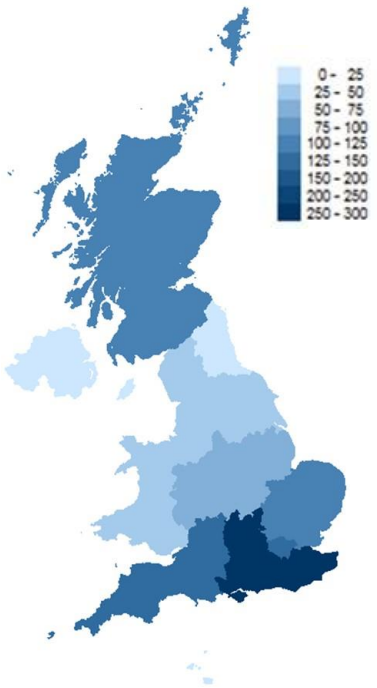
Population

Space-related activity sites are **concentrated in the South and East of England** – comprised of South-East (269 sites), London (138 sites), South-West (126 sites) and East of England (118 sites) regions – followed by Scotland (104 sites). Wales is home to 35 space-related organisation sites, and Northern Ireland has 13 sites. All NUTS1 regions have a count of space-related organisation sites in the double-digits, whilst there were 6 such sites in the British Crown Dependencies.

[13] Eurostat's Nomenclature of Territorial Units for Statistics (NUTS).

UK space organisation population by region, 2014/15

Region	Count of organisations engaged in space-related activities
South East	269
London	138
South West	126
East of England	118
Scotland	104
West Midlands	58
East Midlands	56
North West	48
Yorkshire and the Humber	39
Wales	35
North East	23
Northern Ireland	13
Crown dependencies	6
Total	**1,033**



Note: For organisations with more than one site, each site is counted in the relevant region.
Source: London Economics analysis

The total sums to more than the total number of organisations (697) as many organisations have more than one site, and some organisations have sites in more than one region.

Income

All thirteen countries and regions are home to headquarters of space industry organisations. However, the distribution of total income of headquartered organisations varies greatly across regions.

London's attraction as a domicile for space organisation headquarters is clear, with the majority (**£9.4 billion, 68%**) of total UK space industry income continuing to be generated in the capital in 2014/15. However, as many London-headquartered organisations have activities elsewhere in the country, the geographic dispersion of the space industry is better illustrated in the figure of employment by region (page 18). Reflecting the site population, income is also **strong in the South and East of England**. In total, the three South-Easterly English regions register 94% of total UK space income. The South East (**£1.77 billion, 13%**), has just overtaken the East of England (**£1.76 billion, 13%**) as the second largest region for space turnover, and is the largest region in terms of number of organisations (201 organisations), with London second on 110 organisations.

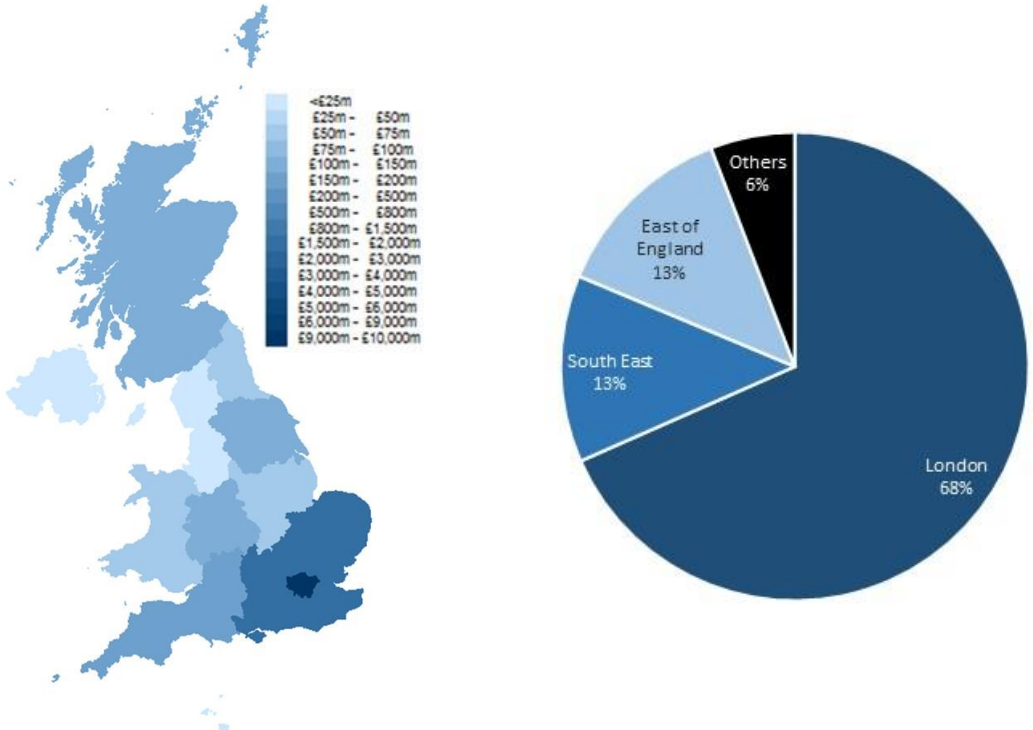
Delving down to income at the segment level, the **East of England leads Space Manufacturing,** while **London dominates the other segments**.

UK space industry income by region, 2014/15

Region	Number of organisations headquartered in region	Income (2014/15) £m
London	110	9,370
South East	201	1,771
East of England	84	1,763
South West	76	176
Yorkshire and the Humber	16	146
Scotland	67	131
West Midlands	37	127
East Midlands	39	68
North East	12	60
Wales	21	58
North West	25	17
Northern Ireland	*Undisclosed*	*Undisclosed*
Crown Dependencies	*Undisclosed*	*Undisclosed*
Total	**697**	**13,702**

Note: Income is wholly attributed to the headquarters of the organisations. To protect confidentiality of survey responses, data for Northern Ireland and the Crown Dependencies have been redacted.
Source: London Economics analysis

Regional distribution of UK space industry income – map and shares (2014/15)



Source: London Economics analysis

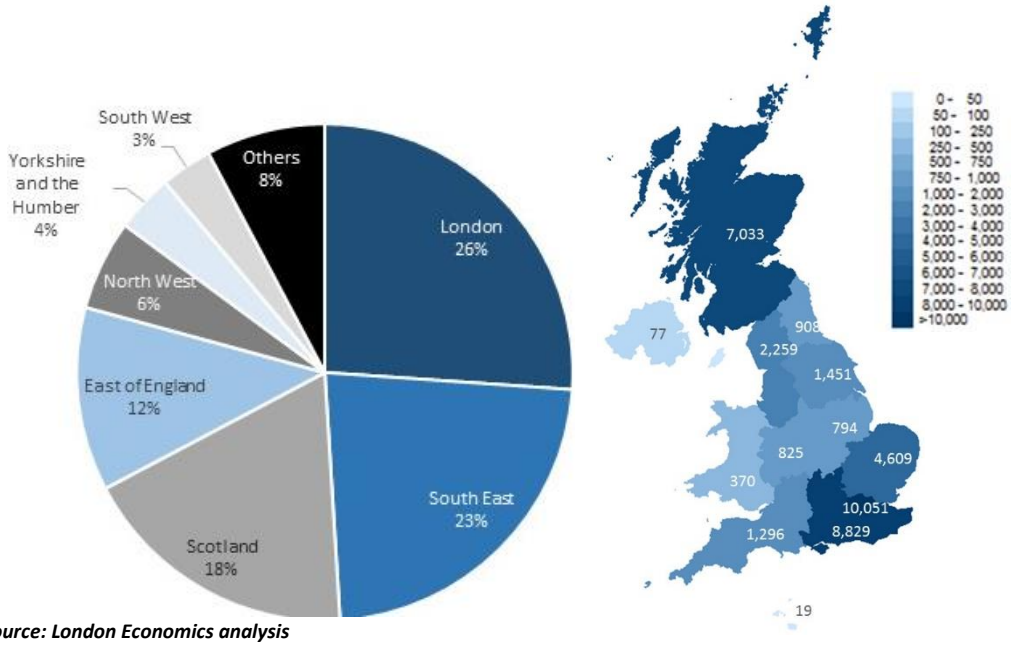
Employment

The regional distribution of space employment is much more evenly distributed across the regions of the UK than income, revealing that large UK space organisations (especially those headquartered in London and the South-East/East regions) have locations in multiple regions.

London and the South East employ the most staff and account for **49%** of all employees combined. After London and the South East, Scotland and the East of England account for the third and fourth largest numbers of space employees, with shares of **18%** and **12%**, respectively.

Scotland stands out as having a much larger share of employment (**18%**) than its share of income (**0.5%**), showing that many UK organisations that are headquartered elsewhere have strong presence in Scotland. A DTH broadcasting call centre in Scotland is a contributing factor to Scotland's strong concentration of regional employment in Space Applications.

Regional distribution of UK space employment – shares and values (2014/15)



Source: London Economics analysis

In the UK as a whole, **0.12%** of the total employed workforce are employed by space organisations, but in Scotland (**0.27%**), South East (**0.21%**), London (**0.21%**), and East of England (**0.17%**), this proportion is considerably higher.

Supply chain effects of the UK space industry

In order to capture the total economic impact of the UK space industry, it is necessary to consider not only the direct impact, but also indirect and induced impacts throughout the economy – by estimating and applying a series of economic **multipliers**.

Gross Value-Added (GVA)

The *Type II* multiplier (direct, indirect and induced effects) is estimated at **1.97**, implying that each £1 of space industry GVA generates £0.97 worth of GVA in the supply chain and supporting sectors. The estimated total contribution of the UK space industry including indirect and induced effects is therefore estimated to be **£10.0 billion** in 2014/15, implying that the sector's direct GVA of **£5.1 billion** generates an additional GDP contribution of **£2.5 billion** in the UK economy through indirect impacts and another **£2.5 billion** through induced impacts.

Employment

The *Type II* employment multiplier (direct, indirect and induced effects) is estimated to be **2.96**, meaning that the activity of **100** employees in the space industry supports **196** additional employees among suppliers and in other economic sectors (such as retail and services). Using this multiplier, we estimate that the total UK-based employment supported by the activities of the UK space industry in 2014/15 is **113,866** employees. Direct employment in the space industry (**38,522**) thus supports **40,296** additional UK jobs through indirect, and another **35,048** through induced effects.

Wider UK GDP supported by satellite services

Beyond the direct effects of the space industry itself, an assessment was made of which (non-space) UK industries employ satellite services in their commercial operations in order to derive an estimate of the **proportion of UK GDP that is supported by satellite services**. To ensure robustness of the estimates, the assessments have been validated through a process of targeted validation interviews with expert stakeholders.

The estimates do **not** purport to be a valuation of the economic value contributed by, nor attributed to, the space and satellite services support, but rather indicate the total value of output of those industries that are supported in some meaningful way by space and satellite services. For example for Precision Agriculture, where cereal farmers employ meteorological information for scheduling, Earth Observation data to monitor crop development, and GNSS to apply variable amounts of fertiliser to plants on different parts of fields. UK agriculture GVA from cereal production is supported by space, as the current, modern business model for a farmer would be seriously disrupted if the signals were lost.

Caveat: The analysis does not cover the full UK economy. Rather, reflecting the coverage of the ONS's Annual Business Survey (ABS), it is limited to the **UK Non-Financial Business Economy** (excludes: financial and insurance, public administration and defence, public provision of education, public provision of health and all medical and dental practice activities), which accounts for approximately two thirds of the UK economy in terms of Gross Value Added.

In total, based on an aggregation of all industrial activities determined to be supported, it has been estimated (2014 data) that space and satellite services (one or more types) support industries representing turnover of at least £651 billion, and contributing **over £250 billion to GDP (13.8%[14])**.

Considering the value of supported economic output by satellite service yields:[15]

- **GNSS (positioning, navigation and timing)** satellite services are estimated to support industries representing a total turnover of more than £486 billion, and contributing **£206 billion** to GDP (11.3%).
- **Meteorological** satellite services support industries representing a total turnover of more than £393 billion, and contributing **£169 billion** to GDP (9.3%).
- **Telecommunication** satellite services are estimated to support industries representing a total turnover of more than £323 billion, and contributing **£117 billion** to GDP (6.4%);

[14] UK GDP from http://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/pgdp. Please note the non-financial business economy (numerator) excludes financial and insurance, public administration and defence, public provision of education, public provision of health and all medical and dental practice activities. The denominator includes all output of the UK economy.
[15] The figure for total value of GDP supported by satellite services does not equal the sum of the four individual satellite service categories as individual satellite services are not mutually exclusive – as outlined for precision agriculture applications in the text.

- **Earth Observation** satellite services are estimated to support industries representing a total turnover of more than £235 billion, and contributing **£89 billion** to GDP (4.9%).

Deeper analysis of the total found that over £150 billion of UK GDP is enabled by satellite services (permanent unavailability of satellite service would require at least major adaptation to restore functionality), and a further £100 billion of UK GDP supported by satellite services in a more minor support capacity (redundancy or enhancement of offering). The importance of the continued operation and outputs of the space industry to the UK economy is clearly demonstrated.

Progress towards 2030 ambitions

The UK government has established a strategic approach to realise several overall ambitions for the size of the industry, to be achieved by 2030. As the definitive measure of UK space-enabled income, employment and exports, this chapter updates the progress report first presented in 2014.

Income

Ambitions: 8% by 2020, and 10% by 2030, of the world's space economy.

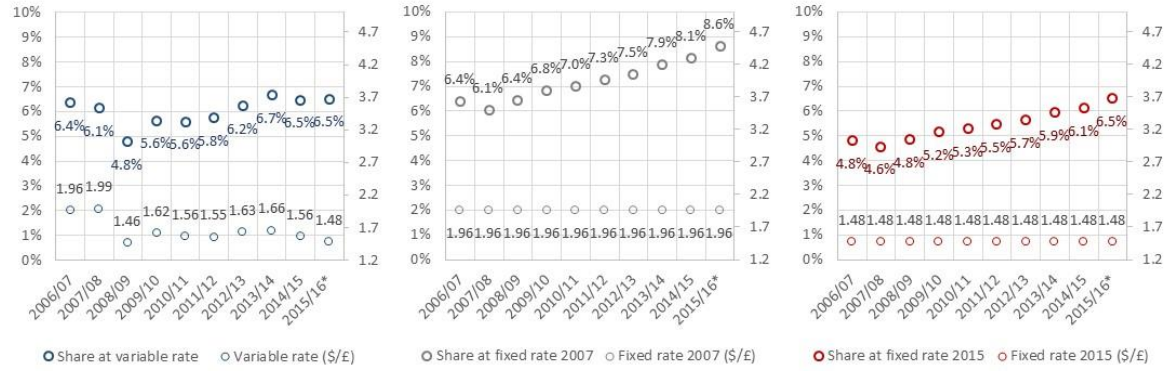
Status: 6.5% of the global space economy in 2014/15 (based on *The Space Report*).

When comparing UK income (expressed in GBP£) with global income (expressed in USD$), the issue of exchange rate fluctuations becomes important – and the effect of currency fluctuations in recent years is substantial. A strengthening US dollar against the sterling implies that UK income growth can be eroded in comparative terms. To understand better the underlying developments of the UK's share of the global space economy, it is instructive to consider different exchange rate scenarios. Three separate analyses are illustrative – the charts overleaf present the UK's share of the global market under three different exchange rate regimes:

- **Variable exchange rates** (left), showing that the significant depreciation of the sterling against the US dollar in 2008/09 had a strongly detrimental effect. At variable exchange rates, the UK's share of the global space economy has increased from 6.1% when the ambition was formulated (2007/08) to the present (6.5%).
- **Fixed exchange rate** (middle and right, fixed at 2007 and 2015 rates, respectively), showing that the UK space industry has grown significantly faster in sterling than the global space economy in US dollars (in current prices, UK space income has increased by 80% since 2007/08, whereas the global space economy has increased by 30%). All else equal,[16] if the exchange rate had remained at the level of the base year of the IGS ambition, the UK space industry would have already achieved its interim 2020 ambition, and been well underway towards the 2030 ambition.

[16] Please note that the weakening sterling has had positive effects on the UK industry's ability to export, so 'all else is *not* equal'.

UK's share of global space economy at different exchange rates 2006/07 -2015/16



Note: 2015/16 forecasted based on survey responses and analysis of annual reports.

Source: London Economics analysis using mid-market exchange rate on 31st January in 'first' year, from xe.com.

Employment

Ambitions: 100,000 jobs created by 2030, equivalent to a total space industry workforce of 119,100.

Status: 38,522 space industry jobs (direct) in 2014/15.

The Space IGS ambitions creation of a further 100,000 space industry jobs since the starting point in 2007 of 19,100. Seven years later, in 2014/15, the space industry supported an estimated 38,522 direct jobs. To achieve the IGS ambition, a compound annual employment growth rate of **7.8%** needs to be realised.

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