



Department
for Transport

Science Plan

The vision for science in DfT

Department for Transport
Great Minster House
33 Horseferry Road
London
SW1P 4DR



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Foreword by Parliamentary Under Secretary of State



The transport sector is the lifeblood of the United Kingdom building a strong and connected local economy, joining our four nations and linking us to the rest of the world. Science will play a critical role in creating the transport system of the future, supporting quality of life in communities across the UK while also aiding economic recovery. Whether it is the journeys we make for work or leisure, or the ease at which the goods we buy find their way to us from across land and sea – transport is an integral part of our social and economic lives.

The science community has provided evidence that has shaped our policies and response during the coronavirus pandemic; it has an equally critical role to play at the centre of our economic recovery. We need to use all the tools at our disposal to ensure that transport plays a key role in the recovery, so that it can benefit every part of the country, further our levelling up agenda and achieve our decarbonisation goals.

If we are to grasp the opportunity that science can bring, we need to plan the way ahead. The DfT Science Plan, read alongside our Areas of Research Interest, provide the structure and direction we need to help us answer the big questions, such as how to make transport greener and improve the health of the population, how to ensure the transport system is safe and secure, and how to ensure all communities have an equal opportunity to achieve their full potential.

The Government has already set an ambitious target to increase UK R&D expenditure to 2.4% of GDP. It is vital that this is focused on where it will make most difference so it can be used to its full potential to build confidence in the transport network, meet the DfT Strategic Priorities and support the recovery. R&D will help us harness the potential of Britain outside of the EU by putting us at the forefront of international development of new and exportable transport solutions.

Research, learning and innovation are all integral to achieving the ambitions set out in this plan. Science will also play its role in creating the transport network for this and future generations, where transport is greener, healthier and benefits all citizens.

This important publication will help deliver on DfT's Strategic Priorities to create the future of transport. Government cannot do this alone, and we must all work together as a single sector – government, industry and academia – to build a better Britain for future generations to come.

A handwritten signature in black ink, appearing to read 'R Maclean', with a small flourish at the end.

Rachel Maclean MP
Parliamentary Under Secretary of State For Transport

Foreword by DfT's Chief Scientific Adviser



Science is critical to delivering our Ministerial and departmental ambitions. DfT and the wider Transport R&D sector must work together to help meet these ambitions and the challenges and opportunities ahead. This Science Plan sets out how we ensure firm foundations for science, research and innovation in DfT and across the transport sector and how we will deliver against our Areas of Research Interest to provide the science required to support the UK's transport policy and delivery needs.

Only through a strong and thriving science ecosystem can we ensure the skills, evidence and collaborations required to underpin and inform the critical transport decisions to be made over the coming decades. Decisions from what apps we use to plan and book our journeys, to new technological innovations to drive down carbon, to influencing and steering public understanding and engagement with transport priorities, through to the future-proofing of our major infrastructure projects. All require excellent people, partnerships and purpose.

The Science Plan aligns with cross-government work to strengthen the science ecosystem across the UK and cement the UK as a science superpower. This means actively improving the diversity and inclusiveness of the R&D sector, building the talent and skills of the future. It means working in partnership across the transport sector and beyond, allowing us to speak with a collective voice, share learning, and join-up to improve the scale, impact and influence of our work. It means having a clear purpose, and the activities and organisation required to deliver against that purpose. All of this needs to happen at a pace that has been redefined by our response to the pandemic, and a pace to match the imperative for action on the opportunities and challenges ahead.

By setting out DfT's Science Plan, we are inviting the broader transport and R&D sectors to work with us and create the transport science R&D ecosystem we need. We want to support the UK's innovators to positively change the UK transport system and to grow and expand internationally; we want to help nurture and grow UK talent; we want the UK to be a test-bed to bring together knowledge, expertise and new ideas, demonstrating UK excellence while solving real UK issues. At the same time, it is essential we use the UK's excellent science base to improve the UK transport system of today and to help the sector's recovery from COVID-19.

Together, the Science Plan and the Areas of Research Interest provide a statement of intent for DfT; a commitment to ourselves and to others of the role of science and the priorities for the years ahead.



Professor Phil Blythe CEng FIET
DfT Chief Scientific Adviser 2015-2021



Professor Sarah Sharples
DfT Chief Scientific Adviser 2021-

Science Plan at a glance

DfT Strategic Priorities

DfT's Strategic Priorities sit at the heart of DfT decision-making:

- *Grow and Level Up the Economy*
- *Reduce Environmental Impacts*
- *Improve Transport for the User*
 - *Increase our Global Impact*
 - *Be an Excellent Department*

The plan for achieving these priorities is outlined in the DfT's Outcome Delivery Plan.

DfT Science Plan

The Science Plan outlines the vision for science in DfT and how we deliver it. It sets out the necessary requirements for policy and science in DfT against three pillars.

*To create a world-leading transport system
that delivers DfT's Strategic Priorities
requires*

*A diverse and scientifically skilled workforce (**people**)
working in partnership with policy, across government, and with
the wider transport R&D sector (**partnerships**)
to shape, use, and share solutions (**purpose**)*

People

To understand and develop the skills and talent needed in DfT and beyond, now and in the future.

Requires knowledge, understanding and use of science by policy and delivery professionals, and deep skills in our experts.

We must have a diverse and inclusive science sector to have maximum impact.

Partnerships

To form the partnerships across government and the transport sector to achieve the scale and focus needed to deliver our Strategic Priorities.

This includes collaborating inside DfT, across government and more widely, both domestically and internationally.

Providing clarity and leadership to the sector.

Purpose

To embed science in DfT decision-making and ensure science activity maintains a focus on departmental purpose.

Establishing the right mechanism to achieve impact and influence, continuous learning, and leading efforts in strategic areas such as Innovation and Futures.

Areas of Research Interest

A companion document to the Science Plan, to communicate DfT's strategic evidence needs. This annually updated document details medium- to long-term priority research themes to be addressed and questions to be answered if we are to effectively and efficiently achieve our Strategic Priorities.

1. Introduction

- 1.1. The DfT Science Plan sets the vision for research, development, engineering, innovation, and natural, social and behavioural sciences in the Department for Transport (DfT) (the term ‘science’ will be used as shorthand to cover all these activities). Placing science at the heart of DfT decision-making, it sets out our future ambition for the role of science in DfT strategy, policy and delivery. It highlights the role DfT is playing in the Government’s ambitious vision for science and outlines how DfT will provide leadership and coordination across the transport R&D landscape, so we can realise the unique opportunities science brings and address the challenges we face together.
- 1.2. There is ongoing rapid change in the transport system, driven by technological development, changes in user expectations and behaviours, demographic change, and new business models that respond to and exploit the potential that data can offer (see [Future of Mobility](#) and the forthcoming Transport Data Strategy). Alongside these ongoing changes are three generation-defining events which require urgent action. First, the UK’s exit from the EU, which gives us greater freedom and control to define our strengths on the world’s stage. Second, a global pandemic which is changing how we live, work, and travel, the choices available to us, and public attitudes and behaviours towards travel. Third, the imperative for urgent climate action to tackle climate change and reduce the environmental impacts of transport as quickly as possible. All three events present a set of circumstances that offer new opportunities and require new ways of working across Government and the wider transport sector. It will not be possible to successfully navigate these challenges without a strong science system aligned with DfT’s priorities.
- 1.3. In this context the UK Government has committed to significant investment in R&D: increasing spend to £22 billion by 2024/25 and [spending 2.4% of GDP on R&D by 2027](#). This is the foundation on which we will cement the UK’s position as a ‘science superpower’. This Science Plan sets out for the transport R&D community how DfT will work in partnership with them to deliver against these ambitions.
- 1.4. While financial investment will be critical to enable the scale of science and innovation necessary to meet these challenges and sustain long-term investment and growth, it is not sufficient to drive the changes we need. This Science Plan sets out how DfT will continue to strengthen our **People**, **Partnerships** and **Purpose**, to support the development and delivery of the UK transport system of the future, both within DfT and across the whole transport sector.

DfT’s Areas of Research Interest

- 1.5. The successful delivery of DfT’s science needs will only be achieved if we work with, and are supported by, partners across government, academia and

industry. One of the ways we will achieve this is through the companion document to the Science Plan, our Areas of Research Interest (ARI).

- 1.6. The ARI details DfT's strategic medium to long-term research and evidence needs by setting out priority research themes and the underlying research questions. By doing this it provides the transport R&D sector – both industry and academia – with the detail required to help them prioritise and focus their work to better influence government decision-making and build future collaborations.
- 1.7. DfT's Areas of Research Interest and the Science Plan complement each other. Together, they tackle the 'what' and the 'how' to ensure DfT and the transport sector are able to support the delivery of DfT's Strategic Priorities and UK transport R&D as a crucial area of UK strength.

2. DfT's Strategic Priorities

2.1. DfT's Strategic Priorities sit at the heart of DfT decision-making and therefore shape the science agenda. Science is crucial in underpinning and driving progress against these priorities, enabling us to generate and measure tangible benefits to people and places. DfT's plan for achieving these priorities is outlined in the department's Outcome Delivery Plan.

2.2. DfT's Strategic Priorities are:

- **Grow and Level Up the Economy:** Improve connectivity across the United Kingdom and grow the economy by enhancing the transport network, on time and on budget.
- **Improve Transport for the User:** Build confidence in the transport network as the country recovers from Covid-19 and improve transport users' experience, ensuring that the network is safe, reliable, and inclusive.
- **Reduce Environmental Impacts:** Tackle climate change and improve air quality by decarbonising transport.
- **Increase our Global Impact:** Boost our influence and maximise trade by having an innovative outward-facing approach.
- **Be an Excellent Department:** Be a well-run department that focuses on delivery, demonstrating excellence in transport policy, driving value for money, and embodying our values in all that we do.

2.3. Science is critical to delivering against these priorities. Activity will range from fundamental research to understand the policy challenges and generate innovative solutions like new modes and business models; Social and Behavioural research to enable policy to be designed with the transport user at its centre; testing and integrating new approaches at scale to quickly deliver benefits for the public, while putting the UK at the cutting edge of transport innovation.

3. Our Plan for Science in DfT

- 3.1. To guide its development within the Department and enable its support of the delivery of the DfT's Strategic Priorities, DfT's vision for science is:

*To create a world-leading transport system
that delivers DfT's Strategic Priorities
requires
A diverse and scientifically skilled workforce (**people**)
working in partnership with policy, across government, and with the
wider transport R&D sector (**partnerships**)
to shape, use, and share solutions (**purpose**)*

- 3.2. To deliver on our vision, our efforts focus on three pillars: **People, Partnerships** and **Purpose**. Success against all three pillars is critical to strengthen and deliver the science that underpins and drives progress against the Strategic Priorities.

- **People.** It is essential that we understand and develop the science skills and talent needed in DfT and across the sector both now and in the future. We need knowledge, understanding and use of science by policy and delivery professionals, and the right deep skills in our experts. We must have a diverse and inclusive science sector to enable it to have maximum impact.
- **Partnerships.** Partnerships across government and the wider transport sector are essential to achieve the scale and focus needed to deliver our Strategic Priorities. This includes collaborating inside the DfT family, across government, and more widely, both domestically and internationally. Through this, providing clarity and leadership to the sector.
- **Purpose.** It is important to embed science in DfT decision-making and ensure science activity maintains a focus on departmental purpose. This will involve establishing the right mechanism to achieve impact and influence inside DfT and across the whole transport sector and through ensuring the department is equipped to lead challenges in strategic areas such as Building Innovation and Futures.

4. People

- 4.1. The foundation of all progress is people: their skills, ideas and energy. The first pillar of the Science Plan is to ensure that the right people, with the right skills, knowledge and understanding are working on the challenges underpinning the Strategic Priorities, both now and in the future. It is essential DfT develop the whole department as well as deep experts to enable us to embed and use science in all we do. Beyond DfT, it is crucial that we help develop and grow the experts and innovators across the whole transport R&D sector.

Capability

Within DfT

- 4.2. As the pace of technological development quickens, the capability, capacity and culture of DfT will need to respond to meet the opportunities and challenges this brings. To achieve this, we will focus on four core capability building workstreams:
- 1. Raise the visibility and importance of science:** Improve the scientific knowledge and understanding of all DfT staff. This will enable them to demand, understand and use science in all decision making, anticipate future technological and social change, and build-in innovation to the way we operate.
 - 2. Support and develop science interests and skills:** Support the development of staff with an interest or background in science. This will build a cadre of experts, help the use of science across DfT, and will improve DfT's recruitment and retention of scientists by being an exciting place for technical specialists to work with a clear career pathway.
 - 3. Develop deep skills:** Invest in and grow deep technical skills within specific individuals and teams. This will enable DfT to maintain access and use of the most needed and useful skills. It will also enable DfT to remain at the cutting-edge of science thinking and develop the skills and careers of our experts.
 - 4. Access external expertise:** It is not possible to anticipate or maintain expertise in all areas. It is therefore essential we have access to deep expertise from external partners, to complement and augment departmental capabilities. This will often be required at pace, so agility will be key to the mechanisms developed to achieve this.

Outside DfT

- 4.3. Highly skilled R&D capabilities across the sector will enable the UK to anticipate, exploit, mitigate and lead technology-driven change. It is therefore

important for DfT to also support scientific capability building in the wider transport sector if the UK is to achieve a world-class transport system underpinned by science. It is therefore essential to work across the sector, helping build capabilities across DfT's agencies and Arm's Length Bodies, its supply chain and across the broad transport R&D sector.

4.4. This can be achieved through:

- working across the sector to identify priority skills gaps and share opportunities for skills development
- supporting academic skills development, for example through PhD Placements and MSc support
- clearly communicating DfT's skills needs, and priorities for the future.

Actions for PEOPLE: Capability

- **Develop general skills and expertise** in key science areas amongst all DfT staff, for example in emerging technologies, Futures thinking, security science, innovation, and behavioural science.
- Create a '**DfT Senior Science Network**' comprised of senior DfT leaders responsible for science, R&D, engineering, data, technology, and innovation to provide leadership and coordination to all DfT science activity.
- **Develop deep skills** in some DfT science experts in identified priority areas (for example data science, systems engineering, behavioural science).
- Develop a mechanism to enable DfT to have **rapid access to deep skills** across the external R&D sector.
- Work in partnership with the Government Office for Science (GO-Science) and the Chief Scientific Adviser (CSA) Network to **reinvigorate the Government Science & Engineering (GSE) career framework** to support science career paths.

Diversity and Inclusion

4.5. Transport affects everyone's life, every day. It is essential for DfT to be representative of the population we serve, to have access to as wide a range of talent as possible, and to support the development and contribution of a diverse range of future talent. DfT are committed to building an inclusive and more diverse organisation, as set out in our [Diversity and Inclusion Strategy](#). Increasing the representation of underrepresented groups across all grades, roles and across all science professions will allow us to better reflect the people and society we serve and bring in the diversity of thought necessary to achieve our vision. Our goal is for DfT to be leaders on diversity and inclusion in both the Civil Service and the transport sector, helping the wider transport R&D sector achieve the same goals.

4.6. Improving diversity and inclusion will cover:

- Encouraging diversity in the way we recruit, identifying and removing any barriers to diversity
- Creating an inclusive and supportive workplace within DfT for all science professionals

- Ensuring opportunities are made widely available across all science professionals
- Supporting all DfT science professionals to reach their full potential, in particular those who have had fewer prior opportunities
- Encouraging diversity in our research and innovation competitions and commissions to encourage a diverse range of applicants
- Ensuring our R&D funding does not disadvantage particular regions
- Ensuring our research collects and uses diversity data as routine.

4.7. One mechanism already available is the [Government Science and Engineering Fast Stream](#), which aims to create a cohort of Senior Civil Servants who have science and engineering skills, and experience of the application of these skills across different areas of Government. The scheme boost diversity through access activities to target underrepresented groups and is currently consulting on entry requirements, to remove requirements which could have a negative impact on diversity.

Actions on PEOPLE: Diversity and Inclusion

- Develop our **talent pipeline** to embrace greater diversity, working with GO-Science and transport science partners to cover all stages of education and routes into employment to encourage transport science careers in DfT and across the transport R&D sector.
- Work with **our R&D partners** to encourage them to support and work with us to deliver against our capability and diversity goals and share good practice.
- Deliver against DfT's Diversity and Inclusion Strategy for the science and engineering professions, **targeting and promoting science vacancies** in a way that tackles any real or perceived barriers at each stage of the process and attracting a more diverse range of applicants.
- Make diversity and inclusion **part of the way we commission R&D**. For example, by building it into grant funding mechanisms, explicitly targeting underrepresented groups, and increasing the diversity of decision-making assessment panels.
- Ensure that diversity characteristics are **routinely collected in our research, monitoring and evaluation activities** to understand differential impact on different groups, 'what works' and to share best practice with others.

5. Partnerships

- 5.1. As a department, and more broadly across the transport R&D sector, we must build effective partnerships and collaborate to achieve our Strategic Priorities. This includes across government, with academia, with other R&D funders, and with businesses of all sizes and backgrounds. Effective collaboration will ensure DfT provides the necessary leadership and direction across the transport science system. By building effective partnerships we will:
- Meet shared goals across a number of transport stakeholders
 - Direct and influence activity across the sector to support delivery of the Strategic Priorities
 - Increase the ambition and scale of projects needed to achieve the Strategic Priorities
 - Enable the transport R&D sector to speak with a single, more powerful voice
 - Encourage innovation across all sectors which could improve transport
 - Share learning across transport modes and the wider sector
 - Build the capabilities and capacities of the transport R&D sector.
- 5.2. Growing and shaping the range and diversity of partners we work with can only benefit DfT, producing more rounded collaborations and innovations.

Partnerships across government

- 5.3. Increasingly the challenges that face government are cross-cutting, and do not sit neatly in one department but are shared across government. It is therefore essential for DfT to engage and work with other departments to achieve many of the goals set out in the Science Plan and ARI: developing the R&D to meet the Strategic Priorities, developing our capability in core and emerging science and the use of science, clearly signalling our science priorities to the external research community and developing and forging collaborations.
- 5.4. For example, decarbonisation is a current cross-cutting priority for the UK government, where a number of government departments all have priority workstreams and related science needs. It will be important for DfT science to work closely across government, notably with the Department for Business Energy and Industrial Strategy (BEIS), the Ministry of Housing, Communities and Local Government (MHCLG), the Department for Environment, Food and Rural Affairs (Defra), the Government Office for Science (GO-Science) and others if we are to collectively achieve net zero by 2050. By working together, we can share learning across sectors, ensure our R&D efforts are joined-up and

efficient, developing solutions are mutually compatible, and avoid duplication of effort.

5.5. Likewise, to achieve our Global Impact Strategic Priority will require close working with the Department for International Trade (DIT), particularly on our capability and innovation plans. Innovations to build the UK transport system of the future will create exportable expertise and technology, helping build the UK economy and the UK's place as a 'science superpower'.

5.6. DfT is a family of organisations, made up of DfT(c) and four Executive Agencies:

- Maritime and Coastguard Agency (MCA)
- Driver and Vehicle Licensing Agency (DVLA)
- Vehicle Certification Agency (VCA)
- Driver and Vehicle Standards Agency (DVSA)

We also work closely with other Arm's Length Bodies, including:

- Network Rail
- High Speed Two (HS2) Limited
- Highways England
- Civil Aviation Authority.

5.7. Through working closely with these Arm's Length Bodies, the focus, impact and influence of our collective work can be greater. By identifying and agreeing areas of common interest, all organisations benefit. We will do this by working with partners to identify areas for joining-up and collaboration, and building on existing networks such as the Chief Scientific Advisers' Network, the Net Zero Innovation Board, HMG's Hydrogen Advisory Council, the National Security Council, the Emerging Technology Board and the Government Construction Board.

Actions on PARTNERSHIPS: Across Government

- **Develop a plan for cross-government collaboration** which identifies the key science partnerships required to deliver on the Strategic Priorities.
- The Chief Scientific Adviser will engage on **key cross-government science initiatives**, such as the Net Zero Innovation Board, the R&D Roadmap, and the BEIS Innovation Strategy.

Collaboration across the transport / academic sector

5.8. DfT routinely collaborates and builds partnerships with bodies across the transport R&D sector. Through this engagement we are able to set out our Strategic Priorities, the implications for transport science and identify opportunities for stakeholders to work together to develop joined-up, impactful solutions that focus on common goals and leverage investment across multiple funding streams.

Transport Research and Innovation Board

5.9. The key mechanism to collaborate across the transport R&D sector is the Transport Research and Innovation Board (TRIB). TRIB is a national Board that was set up by DfT in 2018. Its overarching aim is to provide coordination to the UK transport research and innovation community, to make its research and innovation more joined-up, strategic and impactful. Board members are CEO and CTO level from across government, academia, Research Councils, and from infrastructure operating organisations, such as Network Rail, Highways England and Transport for the North.

5.10. TRIB has a number of ambitious objectives, that include:

- co-ordinating transport research and innovation leaders, funders and activities
- leveraging funding to enable delivery of large scale projects
- facilitating demonstrators to test new ideas at scale
- identifying opportunities to drive forward DfT's Strategic Priorities.

5.11. The current TRIB priorities are: Decarbonisation, Transport Infrastructure, and Innovation through Procurement. These are led by Working Groups made up of members from across TRIB organisations.

Partnering with UKRI and learned societies

5.12. UK Research and Innovation (UKRI), its Research Councils and Innovate UK are critical partners of DfT. The Research Councils fund a large portion of academic research in the UK, and Innovate UK drives innovation between business, academia and local authorities via its technology programmes and Catapult network. DfT will continue to work closely with the Research Councils to focus their programmes on transport priorities, with the Areas of Research Interest a core tool for communicating our needs. Innovate UK deliver a number of DfT's innovation and technology programmes.

5.13. We also work closely and plan to further build our relationships with a variety of professional bodies and learned societies to challenge our thinking and access the broadest pool of expertise and experts. These include the Royal Society, the Royal Academy of Engineering, The Institution of Engineering and Technology and the Academy of Social Sciences.

Transport research programmes

5.14. DfT are keen to work with the transport R&D sector across the UK to ensure we have the people, skills and research programmes we need. The main vehicle to inform these discussions and collaborations is our Areas of Research Interest.

5.15. Our core research programme involves internal research and analysis and externally commissioned work. Commissioned work largely consists of research and analysis to inform the development of strategy, policy, practice or service provision, the shaping of legislation or influencing behaviour. DfT also has a number of R&D programmes to shape the development and operational testing of new technologies and services before they come to market, so they can most effectively and efficiently benefit the transport system, deliver on DfT's Strategic Priorities and drive UK exports and growth.

- 5.16. DfT also provide competitive grant funding, such as through Transport Technology Research and Innovation Grants (T-TRIG); via funding to local and transport authorities such as through Future Transport Zones; via collaborative R&D managed by Innovate UK such as Office for Zero Emission Vehicles and Rail First of a Kind R&D; and via partnership with other departments such as the joint DfT-Home Office Future Aviation Security Solutions (FASS) programmes.
- 5.17. Finally, we also have a central collaborative research and innovation programme with the Connected Places Catapult (CPC) that brings policy makers together with innovators to shape future transport solutions. This collaboration allows the work to both inform policy, strategy and regulation in DfT, and technological and service development for industry and academia.

Navigating the transport R&D ecosystem

- 5.18. We recognise that for those working outside of government, the R&D funding landscape can be challenging to navigate. To enable a clear line of sight and appropriate support on the journey from basic research, through development and into commercialisation, DfT will review the Government funded transport R&D ecosystem and publish a summary to clarify the roles and responsibilities of relevant bodies, how to make contact, and the funding mechanisms which underpin them.

Actions on PARTNERSHIPS: Across the transport / academic sector

- Hold a series of outreach events **to publicise our Areas of Research Interest**, engaging with academia and industry, ensuring each question has a responsive point of contact in the department.
- **Invite Public Sector Research Establishments (PSREs) to apply for innovation support** via DfT's innovation and research competitions.
- **Support the TRIB working groups** to investigate and report on R&D needs in areas such as capital carbon and transport decarbonisation.
- Continue to engage and work with The Royal Academy of Engineering, The Royal Society, The Institution of Engineering and Technology and other professional institutions and learned societies **to engage with a wider network of experts** to support our science needs and ambitions.
- Conduct and publish work to map the government funded **transport R&D ecosystem**.

International engagement

- 5.19. Transport is inherently international: either through the movement of people or goods across borders, or through our transport opportunities and challenges being shared by a broad range of international partners. Many innovations, standards or technology solutions will require mutual agreement before they can be widely adopted and the economic potential of innovation realised. This is particularly evident in certain sectors, notably aviation and maritime, and with specific issues, such as transport security, transport resilience and decarbonisation.

5.20. We use and work with worldwide R&D to most efficiently meet our Strategic Priorities. Through engaging and collaborating we:

- gain access to a wider range of expertise, research and funding
- achieve faster progress in areas of mutual interest
- work together to meet shared challenges, for example on specific technologies or policy challenges
- agree international regulations and standards
- encourage inward investment of R&D funding to the UK
- identify opportunities for UK international leadership and export
- gain access to emerging technologies to engage, anticipate and prepare for change.

5.21. To support these efforts we will engage the Science and Innovation Network (SIN), based in embassies and consulates around the world, which supports international collaboration to enhance UK export, growth and opportunities for beneficial collaboration. We will work closely with the Department for International Trade (DIT) to allow us to map those countries most suited for collaboration and engagement and identify countries to which we can best export our transport R&D expertise, further growing the UK economy. Further, we will work with DIT to promote R&D opportunities to overseas companies to support high impact investment into the UK and to build capability across the sector.

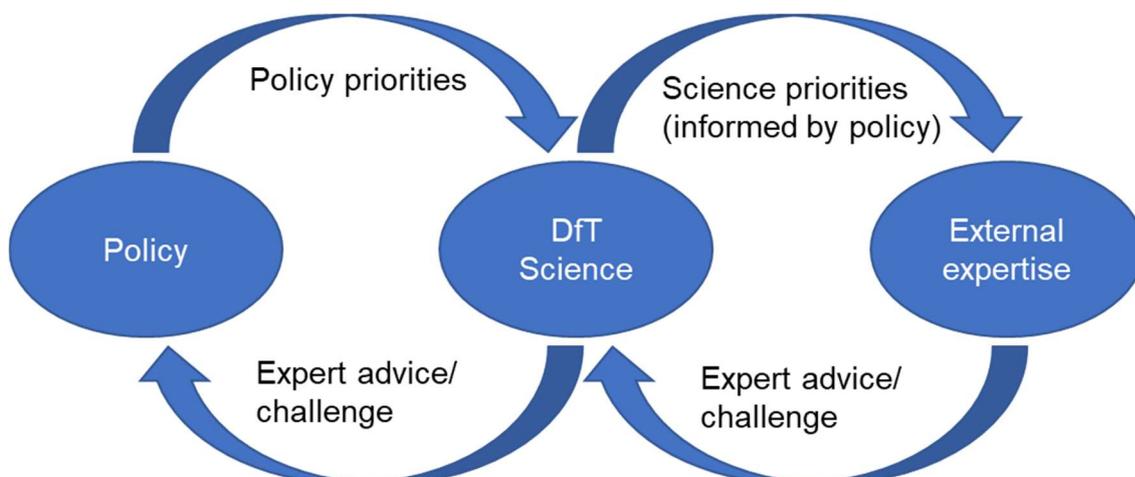
5.22. As part of the UK's exit from the EU, we have retained association with Horizon Europe which is the EU's research and innovation framework programme running from 2021-2027. This has a budget of nearly €100 billion from which UK organisations will continue to have the opportunity to bid. Historically, UK transport R&D organisations were particularly successful when bidding to predecessors of this programme. We will continue to work closely with BEIS, who lead on this relationship, and across the UK transport R&D sector, to maximise the opportunity for UK transport.

Actions on PARTNERSHIPS: International Engagement

- Engage with and **influence the Climate, Energy, and Mobility programme within Horizon Europe**, to steer it toward DfT's Strategic Priorities and to support UK organisations form international collaborations and attract competitive funding.
- Identify the countries who are **international R&D leaders** in the areas which align with the Strategic Priorities, and develop plans for how we best engage with them to learn, share and collaborate, and encourage investment into the UK.
- Work with colleagues in the Department for International Trade (DIT) to understand those **countries with the greatest chance of exporting our expertise and technologies to** and develop engagement strategies to maximise potential growth in these areas.
- Work with DIT to **encourage and support identified global companies** to set up and maximise their investment in the UK.

6. Purpose

- 6.1. The third pillar in the DfT's Science Plan is Purpose. To effectively deliver DfT's Strategic Priorities and create a world-leading transport system necessitates clarity, leadership and governance within DfT and across the sector and a sustained focus on our departmental purpose. It requires science to be embedded in DfT decision-making; expert support and challenge; and leadership in strategic cross-cutting areas such as Innovation and Futures Thinking.
- 6.2. Science advice and support has a wide range of roles in decision making. It:
- provides specialist and general expertise and advice
 - provides challenge
 - provides problem structuring / research framing
 - translates complex scientific and technical findings into plain English and draws out the policy, delivery or strategic relevance
 - steers science projects and advises on the appropriate use of outputs
 - collaborates and joins-up R&D
 - encourages innovation.
- 6.3. Internal decision-making needs to work with both internal science specialists and external experts to create a joined-up and effective system.

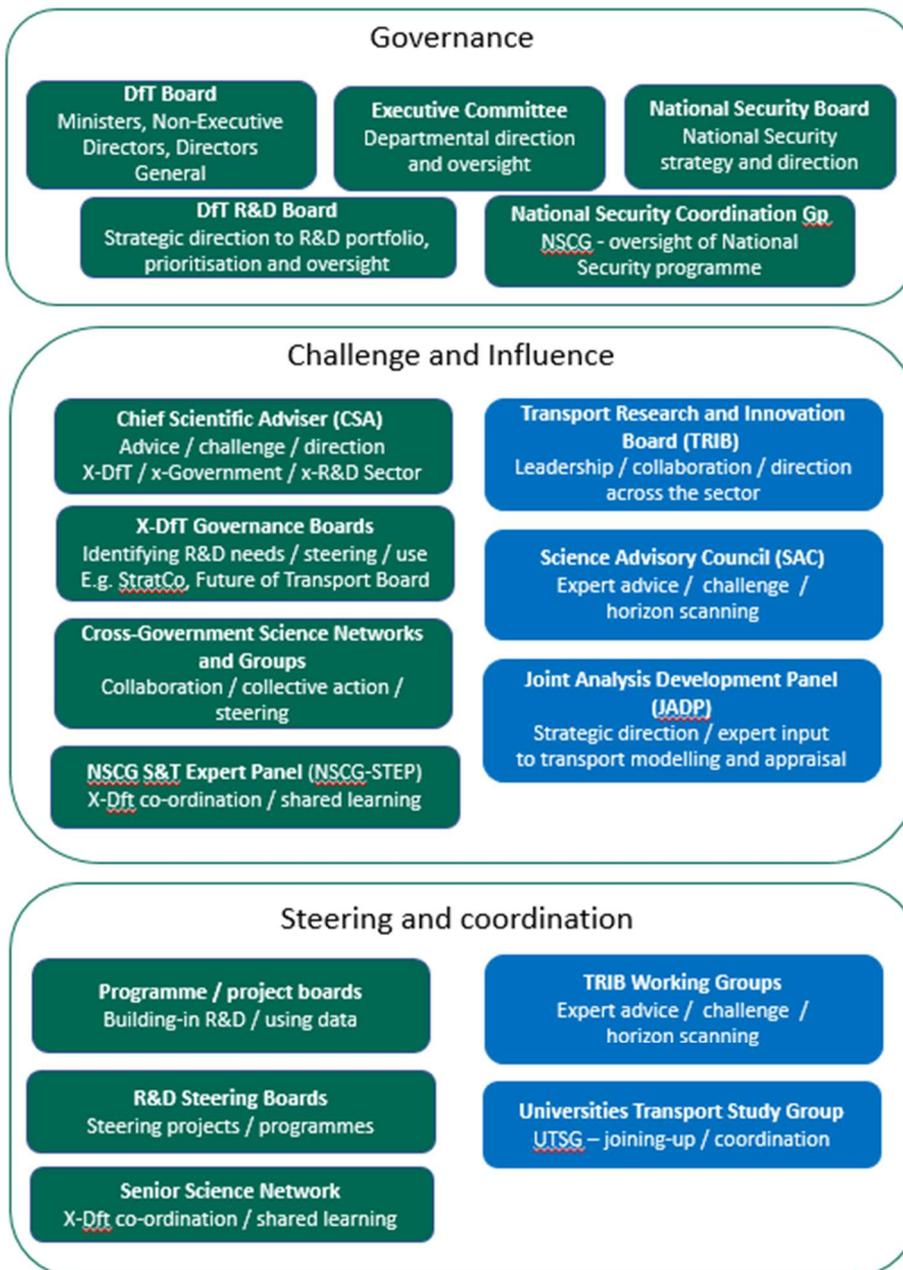


- 6.4. Policy direction allows science to be prioritised and focused to best meet DfT's Strategic Priorities; coordinated across transport modes; and integrated into decision-making. External experts provide robust, independent challenge, expert advice and the input of new approaches and ideas. Internal science

specialists play the roles detailed above and communicate DfT's purpose and needs to the transport R&D sector and identify opportunities for alignment and collaboration.

- 6.5. As discussed under Partnerships, DfT cannot achieve its Strategic Priorities alone. We must influence the wider transport R&D sector to align their investments against our priorities to maximise the impact of their programmes.
- 6.6. The key internal and external boards and bodies that perform these roles are outlined below. Some of the bodies shown perform a governance function as part of collaboration across government and across the sector.

Governance, Challenge and Steering



External
Internal

The Chief Scientific Adviser

- 6.7. DfT's Chief Scientific Adviser (CSA) provides independent oversight and challenge of science evidence and advice. They engage and influence the wider transport sector and work across government on strategic science issues.
- 6.8. The CSA reports directly to the DfT Executive Committee (ExCo) and the DfT Board. They also sit on all senior departmental governance boards such as the Strategic Committee, Carbon Programme Board, and report regularly to DfT Ministers.
- 6.9. This is a crucial role in DfT, reflecting the importance of science in meeting the Strategic Priorities. The CSA's main responsibilities are to:
- Perform an **independent challenge** role for DfT and its ALBs
 - Bring **scientific evidence and advice** to the centre of decision-making
 - **Influence the transport R&D sector** to support the Strategic Priorities and enhance the sector's impact
 - **Join-up** scientific evidence and advice across DfT, across all modes, and across government and the transport sector
 - Develop and assure DfT's **scientific capabilities** and activities, and support our key government partners to do the same.

Actions on PURPOSE: The Chief Scientific Adviser

- The **Chief Scientific Adviser will report directly to both the DfT Executive Committee and DfT Board once a year**, reporting on and gaining buy-in to achievements in the science portfolio, and priorities for the next 6-months.
- The Chief Scientific Adviser will **meet regularly with the Chief Executives of UKRI** organisations, particularly EPSRC, ESRC and Innovate UK, to better align priorities and identify shared work.
- The Chief Scientific Adviser and officials will meet regularly with **science leads in DfT's Arms Length Bodies** and to ensure the alignment and close working across science portfolios.

Governance

- 6.10. Outside National Security, responsibility for developing R&D programmes rests with the lead policy area. **Policy Programme Boards** in these areas should integrate science needs, projects, and the use of the outputs into their decision-making. For example, the Whole Life Carbon Steering Group, provides a scrutiny and challenge and strategic oversight for the Carbon Management Programme. This includes the oversight and use of the supporting research programme.
- 6.11. For National Security science and research, each programme has a programme board that then feeds into their Science & Technology Expert Panel (NSCG-STEP) which itself feeds into the overall governance of the group. These board

provide oversight and challenge from across the department and across government/stakeholders.

- 6.12. Each DfT Strategic Priority has a director-level **Senior Responsible Owner** (SRO) whose role is to ensure there is a coherent programme to deliver against the outcome. This includes whether there is a suitable evidence base or R&D programme to support this, alongside monitoring and evaluation to understand and direct progress.
- 6.13. DfT's **R&D Board** brings together senior modal and strategic leaders from across the department with the Strategic Priority SROs to oversee and challenge the science portfolio; ensure it retains coherence; and meets the departments Strategic Priorities. It aims to share learning, ensure R&D programmes are evaluated, feeds into departmental decision-making processes and is connected to key cross-government initiatives.
- 6.14. It is essential DfT science also joins-up across the **DfT family** (see 5.5) to share information and coordinate on overlapping research priorities where possible. DfT arranges regular catch-ups across these groups via a dedicated meeting of science leads and through bodies such as TRIB.

Actions on PURPOSE: Governance

- The Chief Scientific Adviser and officials will meet regularly with **science leads in DfT's Arms Length Bodies** and to ensure the alignment and close working across science portfolios.
- Develop a **dashboard to track the performance and impact of our R&D board**.
- **Review our ARI on an annual basis**, reporting and gaining agreement from the R&D Board, revising and re-publishing where substantive changes have occurred.

Expert challenge and advice

- 6.15. Expert external challenge and advice is an important way to bring in independent scrutiny, challenge and advice to our planning, our delivery and our outputs. The two main strategic bodies which play this role for DfT are:
 - The [Science Advisory Council \(SAC\)](#) is made up of senior academic and industry experts who provide independent advice and challenge to DfT. It plays a 'horizon scanning' role and conducts deep-dives on specific topics, with input from subject-specific external experts, to bring new ideas and thinking into the department. SAC publishes position papers to influence departmental thinking and an annual report on its activities to encourage transparency and engagement with the wider sector.
 - The [Joint Analysis Development Panel \(JADP\)](#) is comprised of academics and external experts who provide strategic direction and expert input to DfT plans for transport modelling and appraisal methods. It is at the forefront of shaping the analytical agenda, with members steering and influencing the delivery of priorities in our [Appraisal and Modelling Strategy](#). Topics have included levelling up, reflecting uncertainty in appraisal, the development of modelling tools to support appraisal and the Green Book review. We publish an annual report which details the activities of JADP.

Actions on PURPOSE: Expert challenge and advice

- The **DfT Science Advisory Council** membership will be formally refreshed, and a regular cycle of recruitment will be put in place.
- The **DfT Science Advisory Council will publish a position paper** on each of their deep dives and an annual report of their work.

Futures thinking

6.16. There is inherent uncertainty involved in long term strategy, policy and investment decisions, with many of the factors that influence the future of transport system exogenous to transport itself.

6.17. Futures thinking is essential to ensure our decisions are resilient to the uncertainties around new and emerging trends in transport and support the delivery of DfT's wider strategic priorities. DfT's Futures Programme embeds Futures within DfT through:

- Identifying and assessing long term uncertainty and the potential impact of new and emerging technology, social, environmental and business trends on transport.
- Accessing, creating and improving a suite of Futures tools and methodologies.
- Building capability in the application of futures and increasing awareness of future trends and uncertainties.

6.18. The DfT Futures programme must support the appropriate and proportionate use of Futures tool at the earliest stage in the policy, strategy and investment decisions to deliver useful and usable outputs. Futures work includes bespoke qualitative futures projects to explore, test and stretch policy and strategy options; awareness building and the sharing of good practice, including through the Government Office for Science [Futures Toolkit](#) and regular futures updates; and providing guidance, tools and Common Analytical Scenarios for use within Transport Appraisal. It is essential that DfT staff are aware of and able to use Futures approaches, so work is also required on capability building, awareness raising and knowledge sharing, through the development of an internally facing Futures and Uncertainties Portal and targeted training activities.

6.19. The DfT Futures programme will monitor emerging technologies, understand their opportunities and risks for transport and decide and agree whether DfT needs to watch, support, regulate or prepare.

Actions on PURPOSE: Futures

- Develop DfT's ability to **understand and manage the opportunities and risks around emerging technologies**.
- **Pilot a new internal Futures and Uncertainties Portal** to provide guidance on the application of tools and methodologies, and latest information on key uncertainties and trends.
- **Deliver targeted Futures training** to further support capability development in DfT.

Encouraging Innovation

Innovation through SMEs

- 6.20. DfT value the UK's innovative SMEs and start-ups, including the ground-breaking innovation emerging from our world leading universities. This activity also serves to bring innovation into transport from parallel sectors. Tailored support to SMEs is designed to encourage early proof of concept development, bridge gaps, and provide a pathway through to commercialisation.
- 6.21. DfT's Central Innovation Research Programme provides support to the department to understand and apply innovation mechanisms and tools to harness and shape innovation emerging from SMEs, across sectors. This includes our in-house [T-TRIG innovation programme](#), designed to reduce barriers to innovation and advance technology in transport; support smart ideas that have the potential to develop further; and join-up innovators with those responsible for DfT's policy challenges. To further support this programme DfT is working with the Connected Places Catapult's Accelerator Programme, and the cross-Government Defence and Security Accelerator (DASA) to support SME's navigate security and business needs.
- 6.22. There are also modally-focused schemes including First Of A [Kind \(FOAK\)](#), which uses Innovate UK's Small Business Research Initiative mechanism to support SMEs to develop new rail technologies, the [Clean Maritime Demonstration Competition](#), which is looking to support feasibility studies for the demonstration of emerging technologies for the decarbonisation of shipping, as well as the T-TRIG variants: D-TRIG which looks at drone technologies; A-TRIG which boosts accessibility; and S-TRIG in the security technology space.
- 6.23. There remains a challenge, particularly in support to later stage innovation such as through venture capital or equity funding, to overcome the final hurdles to successful commercialisation or the scale up of ideas that originate from our university spin outs, start-ups and SMEs. Work will continue to understand SME needs and explore new partnerships and funding routes for commercialisation.
- 6.24. We will learn from other government departments who have implemented non-traditional methods of procurement. For example, the National Security Strategic Investment Fund (NSSIF) which uses a corporate venturing model and is trialling community licensing rather than traditional procurement, or the National Security Technology and Innovation Exchange (NSTIx) which is based on an ethos of co-creation between government, industry and academia. Examples such as the British Business Banks (BBB) Future Fund is supporting start-ups in the engineering and transport community recover from COVID-19 and Building Back Better.

Innovation through procurement

- 6.25. DfT's large capital programmes offer significant opportunity to drive innovation in the transport sector towards the Strategic Priorities and build the R&D supply chain, while delivering exports and growth. This requires internal work to challenge perceptions of risk, and to overcome perceived barriers to external organisations looking to work on large infrastructure projects.
- 6.26. Collaboration both within and outside DfT is needed to encourage and support the procurement of innovative products and services, innovation in the design and delivery of public services, and innovative procurement processes and models. Through internal governance structures we will continue to support programmes led by DfT's Commercial Group to tackle cultural and technical barriers to innovation. As part of this, TRIB will look to share good practice and build awareness of innovation and procurement, to tackle the issue of risk aversion and demonstrate how, by embracing innovation, you will enhance rather than hinder delivery.

Understanding the potential of high risk, high return innovation

- 6.27. Wider challenges exist around the appropriate procurement routes to fund innovation, particularly high risk, high return initiatives where benefits could include generating evidence to inform future decisions; funding in a new area; and supply chain growth. We will work to encourage the understanding that learning and progress are still achieved in what would traditionally be considered a failed project. For example, the new Advanced Research and Invention Agency (ARIA), based on the successful US Defence Advanced Research projects Agency (DARPA) will be a key ally in demonstrating the benefits of such an approach.

Actions on PURPOSE: Encouraging innovation

- Continue to **develop the T-TRIG mechanism to ensure it is scalable and flexible, and build the T-TRIG brand** by supporting teams across DfT in the running of grass-roots innovation funding calls.
- **Build a broad programme of technology and innovation support** to DfT, bring in a wider group of providers to give DfT with richer support and build broader collaborations across the transport innovation ecosystem.
- Continue to **diversify our procurement approaches to increase innovation** and routes to the market for the whole DfT family.
- Work with partners to ensure that the **government funded transport R&D landscape delivers against DfT's strategic priorities**, and has appropriate support mechanisms from concept to commercialisation for SMEs.

Evaluation

- 6.28. DfT carries out [proportionate evaluation](#) of our interventions, to provide accountability for our use of public funds and learning to [inform future decision making](#). This is particularly important for innovation and R&D programmes as their outcomes are relatively uncertain and their need for learning is greater.

- 6.29. We are embedding evaluation in programmes that will develop the transport systems of the future, for example in the Future Transport Zones and trials of e-scooters where we have commissioned national evaluations to support, co-ordinate and synthesize local authority evaluations.
- 6.30. By embedding evaluation from the start of a programme, we generate both formative learning, to improve design and implementation, and summative learning to understand outcomes. By starting early, we can establish the baseline data, performance metrics and points of comparison that will enable us to understand a programme's impact.
- 6.31. Innovation and R&D programmes require a distinct evaluation approach which recognises that many innovations will not succeed and what matters most is to secure the right learning about how and why they do or do not succeed, to guide future decisions.

Actions on PURPOSE: Evaluation

- Upskill the department on the use of evaluation and ensure all significant **R&D programmes are evaluated** to monitor outputs, track outcomes and understand what difference is made. The R&D Board will oversee our progress with this activity.
- **Develop a monitoring and evaluation approach for this Science Plan**, to be overseen by the R&D board.