Department for Transport

DfT Science Advisory Council

Annual Report February 2015 –January 2016

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1. Executive Summary

The DfT Science Advisory Council (SAC) is an advisory non-departmental public body that provides expert independent advice on science policy and strategy to the Department. In its second year of operation, the Science Advisory Council has clearly built on the momentum established in the previous year. The Council has continued to provide advice and challenge on a wide range of issues, including remotely piloted aircraft systems (RPAS), the Energy Research Partnership project on Energy Options for Transport, and strategies for Highways England and the Transport Systems Catapult. Furthermore, the Council has produced reports on two discrete projects commissioned by the Chief Scientific Advisor, on Intelligent Infrastructure and Condition Monitoring, and Insights into Customer Satisfaction Across Transport. The Council has also maintained a role as a foresight thinker and undertaken horizon scanning to highlight emerging issues that the Department should consider in the near future.

The Council has made a significant contribution to a range of policy areas. For example, the Council made a number of observations and recommendations whilst discussing remotely piloted aircraft systems, which included developing a regulatory framework for using drones in different markets. It was also recommended that early public dialogue would be helpful in addressing public acceptability issues. The advice and comments made by the Council align with the programme of work undertaken by the cross-government working group convened to look at integrating RPAS into UK airspace.

The Council made a number of recommendations to help inform Highways England's innovation, technology and research strategy. These included more collaboration between Highways England and others on research programmes to maximise efficiency and enable better connectivity between the strategic road network and local road network. Discussions around accurate measurement of customer satisfaction also led to a sub-group being formed to address this issue in more detail. The Council's advice was taken on board by Highways England, with the government company seeking further input from Council members at workshops set up to explore the issues raised.

The Department's horizon scanning activities have also benefitted from the Council's contribution in helping refine a new horizon scanning service. Complementary to that, the Council has been pro-active in highlighting emerging issues for the Department to consider, such as establishing strategies to increase resilience of transport infrastructure and networks to extreme weather, and reviewing appraisal methods. Moreover, individual members' expertise have been called upon at short notice, as with the vehicle emissions project commissioned by the Government Chief Scientific Advisor Sir Mark Walport.

Overall, the Science Advisory Council has built on the good progress made last year and continues to provide a valuable resource of strategic science

and technology advice. Important lessons have been learned in how best to make use of the Council and these will be applied in the coming year to support the Chief Scientific Advisor and the Central Research Team.

2. Foreword by DfT Chief Scientific Advisor

Since I have been in post as the Chief Scientific Advisor (CSA) I can say that there have been some real challenges but also some interesting and exciting issues to take on as science, technology and innovation are central to the Department's ability to deliver its programme of infrastructure and transport systems improvements.

My role as the CSA is to ensure that the Department's scientific and engineering activities are well directed and that DfT's policies are based on sound evidence. This means providing challenge to the scientific content and quality of the policies, at a strategic level, to ensure that both the right research is commissioned and that high quality scientific and engineering evidence is used in policy development.

The Science Advisory Council helps me deliver in my role as a key advisor to Ministers and senior officials through the Council's challenge function and the breadth of science and engineering expertise of the Council's membership.

The Council was formed in January 2014 and the value it brings to the Department is evident from the interaction and engagement the Council has with the DfT and wider family. Council members come from academia and industry with a broad range of expertise and bring with them a wealth of knowledge and experience. The Council made good progress in its first year and now, with a CSA in post, has built on that momentum to now be seen as the critical friend of the Department that provides strategic level advice and challenge to support the Department on science and engineering issues. As discussed in the report, members of the Council have been instrumental in providing a strategic overview on issues and also helped strengthen the Department's relationship with the wider academic and industry communities.

This year has seen the Council provide advice and analysis on a range of issues from remotely piloted aircrafts to energy options for transport. Furthermore, the Council has provided a more strategic outlook on what innovation looks like for Highways England and challenged the Department to look further at specific areas related to transport. Moving into the coming year, I look forward to working with the Council in providing key timely advice and challenge, and continuing to help DfT identify new scientific challenges not currently on the Department's agenda.

I would like to thank the members of the Council, and in particular, the Chair, Professor Lord Mair, for their time and contribution in what was a challenging but successful year. The coming year will inevitably present new challenges, but we will aim to build on the impact already achieved, and further promote the Council's role within the Department, and wider family.

3. Foreword by Chair of the Council

The primary role of the DfT Science Advisory Council is to provide strategic independent advice and challenge to the Department on key Science, Technology, Engineering and Mathematics (STEM) issues.

The Council has now been in operation for two years and was tasked with ensuring the DfT had a shared understanding of the evidence needs required to support policy across a broad portfolio. The Council supports the Chief Scientific Advisor (CSA) in ensuring that policy development takes account of broader academic engagement and that scientific evidence underpinning policy is robust. Constructive challenge from the Council has also helped highlight uncertainties and provided strategic steer on a range of very important topics.

In our second year, we have covered a range of topics that span the broad spectrum of science and engineering issues associated with transport. We have also had more of a foresight horizon scan of emerging issues, and helped the Department consider issues that are not currently on its agenda.

The Council has again had the opportunity to engage with senior officials in the Department. Most notably, we have had very effective discussions with the Permanent Secretary, Philip Rutnam, the Directors General and Non-Executive Directors. This level of engagement recognises the significance of scientific evidence in policy development and their engagement has been a key feature of the Council's operation.

It is important that the Council maintains independence and can initiate as well as respond to the challenging needs of the Department. We have discussed a number of technical topics, as well as take a foresight look at emerging issues. We have had the opportunity to better understand the newly formed Highways England and provide key advice on its innovation strategy. We now look forward to bringing further challenge to the Department on broader issues in transport.

Finally, I have had the pleasure of acting as Chair of the Council for a second term and would like to acknowledge the commitment, contribution and enthusiasm shown by my fellow members. I believe we have strengthened the Department's relationship with the wider academic and scientific communities and look forward to continuing to work with the Department's CSA to support and challenge the DfT on its use of science and engineering evidence.

4. Introduction to the Science Advisory Council

This is the second annual report of the Department for Transport's Science Advisory Council (SAC) and covers the period February 2015 – January 2016. This report is being published to meet the Government's requirements of openness and transparency as promoted by the Civil Service Reform for open policy making[1].

This annual report is a review of the Council and its activities. It aims to evaluate and assess the impact of the Council over the past year and analyses the discussion topics held throughout the year, highlighting the recommendations and advice given. The report also provides an overview of the change of structure and model of how the Council operates and the interaction with the Department.

The DfT Council was established in 2014 with the aim of providing strategic advice and challenge to the Department for Transport on key Science, Technology, Engineering and Mathematics (STEM) issues and mirrors Councils established in most delivery Departments of Government.

The Council is formed of eminent academics and experts from business and supports the Chief Scientific Advisor (CSA) in both ensuring DfT key policies (and service delivery) are underpinned by the best STEM evidence, and strengthening the Department's relationship with the wider academic community.

[1] http://www.civilservice.gov.uk/wp-content/uploads/2012/06/Civil-Service-Reform-Plan-acc-final.pdf

5. Review of the Council

5.1 Membership

The membership of the Council was extended to eight members over the course of the reporting period. As identified in the Council's annual report last year, further expertise in other relevant areas would be beneficial to extend the range of expertise on the Council. This led to Professor Eddie Wilson, Professor of Intelligent Transport Systems and Head of the Engineering Mathematics Department at the University of Bristol, being invited to join the Council.

The Council still holds an *ad-hoc* formation and it is expected that this will continue for a further year. Over the course of the following year, it is intended to formalise the Council in accordance with the Nolan principles (**5(i) Annex B**). The membership will be increased through formal recruitment of new members, giving the Council a formal status. The current Council membership is listed in **Table 1**. Biographies of members can be found at **Annex A**.

Table 1: Membership of the Council

Member	**Institution**
Professor Lord (Robert) Mair (Chair)	Sir Kirby Laing Professor of Civil Engineering, Cambridge University
Mr Paul Stein	Chief Scientific Officer, Rolls Royce
Professor Paul Newman	Professor of Information Engineering, University of Oxford
Ms Sue Duncan	Independent research consultant & Visiting Professor of Policy Studies, University of Lincoln
Professor Barry Clarke	Professor of Geotechnical Engineering, Leeds University
Professor Ricardo Martinez-Botas	Professor of Turbo-machinery, Imperial College London
Professor Peter Jones	Professor of Transport and Sustainable Development, UCL
Professor Eddie Wilson	Professor of Intelligent Transport Systems, University of Bristol

While the Council has been set-up on an *ad-hoc* basis, the Department has followed Nolan Committee principles wherever possible. All members are responsible for ensuring independence, objectivity and impartiality and have declared any conflicts of interest with the remit of the Council. This has been further enforced through agreement of Terms of Reference (ToR), **Annex B.**

The Council contains a mixture of senior academics and industry representatives. The Department was keen to secure a balance of academic and industry perspectives on the Council to ensure input, and a strong relationship, with both of these key sectors. Council members were chosen

from individuals eminent in their field who have the ability to constructively challenge the Department across its full policy portfolio.

The Council membership covers the broad landscape of the scientific, engineering and social sciences. The current membership of the Council meets the needs and objectives set out in the Science Advisory Council ToRs. However, the balance of skills, experience and expertise remains under regular review to strengthen the Council's areas of expertise. New skills and expertise will be more fully specified prior to formal recruitment of new Council members, taking into account changes in Departmental needs and priorities.

There continues to be an option to supplement the expertise of the Council through temporary appointment of experts on relevant subjects on an *ad-hoc* basis. This option was used over the course of the year, where relevant, providing an efficient route to specialist external advice. This approach ensures the Department's scientific and engineering evidence base is being developed through effective external engagement.

5.2 Governance

The Council reports to the DfT CSA via the Chair. This report provides a review of the Council's activities for its second year of operation. The main audience for this report are Senior Officials within DfT and Ministers.

The Council operates within the Government Office for Science's Code of Practice on Scientific Advisory Committees[2] and the principles of Scientific Advice to Government[3]. These set out the rules of engagement between Government and those providing independent scientific and engineering advice.

The Council aims to be as transparent and open as possible. To this end, the Council secretariat maintains a record of minutes for every meeting. The secretariat also make available appropriate information regarding the Council to the Government Office for Science.

In light of changing Department policies and priorities, and the addition of new members to the Council, the Terms of Reference will be reviewed to ensure they remain fit for purpose.

5.3 Structure of Business

The Council is supported by a secretariat of DfT staff who assist the Chair and members of the Council in their role and promote the Council within the Department.

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278498/11-1382-code-of-practice-scientific-advisory-committees.pdf

[3] https://www.gov.uk/government/publications/scientific-advice-to-government-principles/principles-of-scientific-advice-to-government

The structure of SAC business is organised in a variety of ways. Generally, full-day meetings are held on a quarterly basis covering one major discussion topic as well as standing agenda items. Where the topic has allowed, a workshop has been held in place of a meeting, as with the horizon scanning topic. Some meetings include a working dinner, providing a useful opportunity for the Council members to engage with senior officials, non-executive Directors and the Permanent Secretary.

Specific topic areas are taken forward by sub-groups, formed as 'task and finish' groups, set up to look at a particular area and report back to the CSA via the SAC Chair. These groups disband once the group completes the task. Two such groups were formed to look at *Condition Monitoring and Intelligent Infrastructure* and *Insights into Customer Satisfaction across Transport*. The reports from both these groups are published alongside the annual report as separate documents.

To ensure balanced, informed and productive discussions take place meetings are attended by policy colleagues, external speakers from other government departments and external organisations. *Ad-hoc* experts are also invited to attend meetings on specific subject areas. Where possible, senior level attendance by Directors General or Directors is encouraged.

6. Council Discussion Topics

The section below provides an overview of the main topic areas discussed at each SAC meeting from February 2015 to January 2016. A separate section follows which details other SAC activities such as the task and finish groups set up to look at specific topic areas. Other activities undertaken by members are also detailed, demonstrating the wider use of the expertise on the Council.

The Council provided valuable advice and challenge on these topics, as outlined below. More information on each discussion can be found in the minutes of the relevant meeting. The topics discussed so far have included: Remotely Piloted Aircraft Systems; Highways England's Innovation Strategy; Horizon Scanning and Emerging Issues; and Energy Options for Transport.

6.1 Remotely Piloted Aircraft Systems

[Discussed at SAC meeting on 25th February 2015]
Remotely Piloted Aircraft Systems (RPAS) or drones are becoming more widespread since their first use in the 1950's. Their use matured rapidly in the military context, and with advances in technology they are becoming more prevalent in the civilian market, leading to a range of issues facing aviation regulators.

The Department's policy lead on RPAS produced a paper discussing the use of terminology, the opportunities and challenges of RPAS and the cross government group convened to look at how RPAS can be integrated into UK airspace. The paper acknowledged the use of RPAS in many niche areas, including by Highways England for inspections, the oil and gas industry for pipeline inspections and airlines. It also noted commercial, leisure and disaster relief opportunities.

The Council made a number of observations and recommendations. This included noting that the UK is likely to play a leading role in the development of manufacturing capability and services using RPAS, leading to new high-tech jobs and growth in the economy. However, discussions around policy and regulation driving this were noted. It was broadly accepted that the main challenge to address widespread use of RPAS is regulation and not technology. Regulation would also have to consider safety, security and privacy issues, and that identification of drones would help in the event of serious misuse or any incidents that may occur.

The range of application areas of this technology were also discussed, namely the leisure market, service industry, commercial opportunities and disaster relief. The Council recommended a regulatory framework be developed for using drones in the service industry to drive forward the technology, and then tackle the issue of drones for leisure activities. The Council suggested that a distinction be made between serious commercial service vehicles and drones for leisure, and each be regulated separately as

drones for leisure use have the potential to pose the greatest risk to aviation. It was also mentioned that other government departments will need to play a role in establishing regulation around the leisure market and that consideration should be given to regulating on size of RPAS, speed, weight and battery size.

As with autonomous vehicles, the Council recommended thought should be given to communication to the public when the first major accident or incident happens, as initial public response to this inevitable event could adversely affect take-up of these technologies.

The advice and comments made by the Council have broadly been adopted by the programme of work undertaken by the cross-government working group convened to look at integrating RPAS into UK airspace.

6.2 Highways England's Innovation Strategy

[Discussed at SAC meeting on 22nd June 2015 and 25th September 2015]
The innovation, technology and research strategy was discussed for the newly formed Government-owned company – Highways England. On 1 April 2015, Highways England (previously an Executive Agency of DfT) was transformed into a government-owned company. The change brings many challenges for Highways England in managing and delivering the Strategic Road Network through significant research and investment. The Council was invited to discuss the key drivers and areas of research and innovation and how the company can most effectively ensure innovation plays a central role in delivering against the detailed investment plans in the Road Investment Strategy.

The Council made a number of recommendations to help inform Highways England's innovation, technology and research strategy and help shape investments in big schemes; short term wins, as well as blue sky thinking. In order to maximise efficiency and enable better connectivity between the strategic road network and local road network, the Council commented that collaboration with other entities, such as the Research Councils, Innovate UK and the Catapult centres on research programmes will be beneficial. Members discussed the potential for this cross-collaboration to improve users' whole journey experience and integration with other modes through better data management and sharing. This would also consider what role research and innovation would play in multi-modal issues.

On the issue of technological innovation, the Council suggested that a percentage of funding is needed for areas of high risk innovation and that a culture of risk be adopted as part of the strategy. A range of innovation topics for Highways England to explore included sensing for road safety and collision avoidance systems. Members commented on the potential of eye-tracking technology as used in other sectors.

Council members raised questions related to the assessment and evaluation of the road network. A discussion of the need to accurately measure customer

satisfaction with a single subjective value took place. It was highlighted that a number factors determine an individual's assessment of satisfaction and that these are likely to change over time. It was also noted that the difficulty of measuring user satisfaction is partly due to road users not differentiating between different networks and partly because of the challenge of identifying which routes and journeys are being assessed.

Members suggested it may be of value to have earlier engagement with users to explore decision-making aspects of their journey experience. It was also recommended that evaluation outcomes should feed into the appraisal process and users be involved in shaping the network.

6.3 Horizon Scanning

[Workshop held on 25th September 2015]
To help ensure horizon scanning forms part of the remit of the Council, a workshop facilitated by the Department's new horizon scanning and technology watch provider was held as part of a regular SAC meeting. The workshop was attended by 40 influential stakeholders representing different sectors and institutions with an interest in transport. The main aim was to further improve the Department's capability and understanding of the risks and opportunities that technologies and processes may have on transport and mobility in the future.

Attendees included members of the Science Advisory Council and representatives of DfT, industry, DEFRA, the Government Office for Science, Catapult centres, the Knowledge Transfer Network, Innovate UK, Energy Research Partnership and Highways England.

The results showed that the thematic areas for consideration were: human factors; new ways of working; infrastructure; data to achieve outcomes; resilience; security; governance; and collaboration. Further analysis of the results has helped inform the key areas for the Department's horizon scanning and technology watch service to focus on, which included: facilitating new ways of working; delivering improved service; understanding the human in the loop; energy solutions; delivering resilient systems; and infrastructure. A report of the results was produced and can be obtained from the SAC Secretariat. The report was shared with key internal and external stakeholders and used to help the Council consider future challenges and topics for consideration for the year ahead.

6.4 Emerging Issues

[Discussed at 7th December 2015]
The final meeting of the reporting period built on the previous meeting on horizon scanning. Council members were invited to identify key opportunities and challenges the Department faces. Based on their experience and expertise, members were asked to highlight key areas the Department should be addressing in the near to medium future.

In broad terms, areas that were highlighted included a better understanding of the vulnerability of transport assets to extreme weather, as issues associated to climate change are likely to increase. The interconnections between transport and other areas, for example, land-use and energy was highlighted as one which requires further attention. It was discussed that increasing focus is needed on linking future housing provision with investment in road and rail infrastructure. This would help overcome silos, and open up the potential of having multi-functional corridors by allowing for a systems thinking approach.

Systems thinking featured as an area which should be considered, particularly with changing transport modes and choices affecting energy demand, e.g. electric vehicles and energy demand. A systems approach would allow better, more considered interventions when developing solutions, as well as development of roadmaps for future technologies.

Innovation was mentioned in that a better understanding of the causes of resistance to innovation is needed. Earlier public engagement and market research could help understand the drivers. Members commented that it is important to embrace innovation whilst keeping a focus on policy direction and that innovation should address policy objectives. Maritime was identified as an area which needs to keep up with the rapid pace of technological change.

Congestion and better management of capacity was highlighted as an area which needs further thought. Demand management was mentioned as a methodology to consider, particularly with the volume of data collected on transport use.

A further look at vehicle emissions was mentioned, as well as a review of appraisal methods. Consideration should be given to what the evidence is with the effectiveness and availability of on-board measuring systems, and vehicle certification in collaboration with Europe should be explored. Techniques used for appraisal methodology are old and not fit for purpose. Therefore, to examine the impact of policies on liveability and other key issues, appraisal methods should be updated.

6.5 Energy Options for Transport

[Regular item on the agenda for SAC meetings]
In 2014, the Council was invited to help shape the scope of a project being led by the Energy Research Partnership (ERP) into energy options for transport. Over the course of the project, the Council's expert advice has been sought with updates on the project being discussed at each SAC meeting.

The Council was invited to comment on the interim report, noting that social and behavioural aspects should be taken into consideration for people's preferences related to future fuels. In order to better understand the unintended consequences of future fuels, scenario planning was also recommended. The Council advised the need to consider that many of the fuels being discussed were unlikely to meet air quality standards. Taking a

long-term strategic perspective, the Council advised on current research in the UK on using gas stations to transport hydrogen which could help inform the evidence base on future transportation of hydrogen. Council members also highlighted research by the Joint Research Council on synthetic fuels and the drawbacks mentioned in using this source of energy at the EU level.

The Council's expertise and advice has been of great value over the course of the project, with many of the recommendations being taken forward and implemented.

7. SAC Sub-groups

The Chief Scientific Advisor, Professor Phil Blythe, commissioned the Council to take forward projects in two discrete areas: *Condition Monitoring and Intelligent Infrastructure;* and *Insights into Customer Satisfaction across Transport.*

The task was to form a sub-group of the SAC, with additional experts as needed, draw on the current available evidence and make a number of recommendations for the Department to take forward. The two topics resulted from discussions at a working dinner with the Permanent Secretary, Director Generals and Non-Executive Directors to ensure the Council is fully cogent of the priorities and concerns of the DfT executive.

7.1 Condition Monitoring and Intelligent Infrastructure

[Workshop held on 25th November 2015]
Many opportunities exist for modern transport infrastructure to be robust, resilient and adaptable to changing patterns. It is also recognised that for infrastructure to be optimised in terms of efficiency, cost, low-carbon, it can benefit enormously from being 'smart', which involves the innovative use of emerging technologies in sensor and data management.

The sub-group looking at condition monitoring and intelligent infrastructure brought together key transport stakeholders from academia, government bodies, industry and cross-sector transport organisations. A workshop was held to discuss how the use of existing and emerging technologies could help better manage and maintain the UK's transport assets. The group was tasked with making recommendations, whilst considering the challenges and opportunities in implementing intelligent technology systems to monitor the health of assets.

A report by the sub-group has been circulated to senior officials and the Permanent Secretary to consider how to take forward the recommendations.

The workshop was structured around key themes and questions asking delegates to consider what essential criteria are needed to enable condition monitoring, the tools and technologies available, and their deployment. Key challenges, how to overcome them and how the Department can act as an enabler in driving condition monitoring and intelligent infrastructure forward also formed part of the discussions. The broad, overarching recommendations made in the position paper included developing an understanding of the country's current assets and work in exploring standards that can be widely accepted.

7.2 Insights into Customer Satisfaction across Transport

The purpose of this project was to review the increasing use of customer satisfaction in transport operations and delivery. These measures can help drive improvements in the performance of existing systems and networks. For more policy focussed questions and future planning, broader social, attitudinal and behavioural evidence is required. A comprehensive understanding of satisfaction requires more than a simple, single satisfaction question (although this too is important), and may include expectations and the views of non-users. Customer satisfaction measures are of most value when seen in context – understanding what it represents but also other measures e.g. objective measures of service and complaints.

A position paper has been circulated across the Department to consider the recommendations made, noting practical suggestions on how to collect information to allow cross-modal comparisons.

The think piece highlighted that customer satisfaction is increasingly feeding into decision making, service delivery and accountability through KPIs (e.g. Single Departmental Plan) and Franchise agreements. It is important that measures that feed into KPIs and other investment and decision making tools are robust and fit-for-purpose. In order to do this, the breadth of stakeholders needs to be considered. Stakeholders need to be engaged and share information, and where possible there should be consistency in measures.

Further work will consider how to maximise quality and value for money in this area by taking a more cross-modal approach. Measures need to be replicable, actionable, valid and reliable.

8. Other Engagement

Council members were actively involved in a number of activities outside the formal role of a Science Advisory Council member.

Professor Peter Jones was asked to co-chair the Joint Analysis Development Panel (JADP). The JADP aims to provide comment and recommendations on the direction and technical merit of the Department's approach to developing its transport modelling, appraisal and evaluation guidance and methods.

The Government Chief Scientific Advisor, Sir Mark Walport, commissioned Professor Phil Blythe to lead on a review of the evidence on vehicle emissions, in collaboration with CSAs from DEFRA, DECC, BIS and DfID. The review, submitted to Ministers in January 2016, provided independent scientific advice to inform policy on light duty vehicle emissions standards and testing procedures for greenhouse gases and hazardous air pollutants.

In providing independent scientific advice, Professor Ricardo Martinez-Botas played a key role in chairing a number of workshops looking at vehicle

emissions measurements and vehicle engineering with the wider scientific community, including academic and industry experts.

The timescales associated with the project were very challenging, and the existing link with Professor Martinez Botas through the SAC enabled early engagement with him on the aims and structure of the workshop. He was instrumental in rapidly identifying the most appropriate academics to attend, and facilitating effective communication between the group of academics and the project team. Overall, Professor Martinez Botas' input was invaluable in allowing the project team to obtain useful, accurate and timely scientific input.

9. Departmental Interaction

Over the course of the reporting period, the Science Advisory Council's visibility has increased both externally and across the Department. The Council has continued to fulfil its core responsibility of providing strategic oversight and expert independent advice on a number of science and engineering related topics.

The formal reporting channel for the Council remains through the DfT Chief Scientific Advisor (CSA). Professor Phil Blythe joined the Department midway through the reporting period as CSA and an effective close working relationship with the Council has developed. This has enabled the Council to provide robust challenge and advice on a number of issues to the CSA.

The Chair of the Council also met with Claire Perry MP - Parliamentary Under Secretary of State in April 2015 to discuss the Council's activities reflected in last year's annual report. It is intended that the Chair will meet with a Minister after the publication of this annual report.

The Council has continued to have working dinners with senior officials in the Department after alternate meetings with Claire Perry (just before the General Election). The Permanent Secretary, Non-Executive Directors and Director Generals all attended a working dinner on 25th June 2015 with the Science Advisory Council. This ensured visibility of the Council with senior figures in the Department and an opportunity to raise the awareness of the Council's capabilities. A direct result of the working dinner was commissioning the Council to form sub-groups to take ownership of the two topics discussed above, condition monitoring and intelligent infrastructure, and insights into customer satisfaction across transport. This is a good example of where interaction with senior officials has resulted in the Council being tasked with providing the Department with a specific piece of work.

One action arising from the last annual report was to establish a mechanism by which individual members' expertise can be used within the Department, outside of the standard SAC meetings. Although developing a formal mechanism is still in progress, individual members have been called upon to provide their expertise on several projects, a particular example is a project looking at real world vehicle emissions testing regimes. Members were also invited to contribute to Highways England's innovation strategy workshops directly by the company as a result of the advice given at a SAC meeting.

10. Impact of the Council

The Council's visibility has increased which has in turn helped the Council make an impact across the Department. Key areas where the impact is clearly evident is on the Energy Research Partnership project, Highways England's innovation strategy and the Transport Systems Catapult's technical research and innovation strategy.

The advice and challenge given on the ERP project has been taken on board and initially helped shape the project to reflect the Department's needs. Regular engagement with the Council has allowed the project team to better define the issues the project was set up to look at. The Council's advice has also helped shape the project deliverables.

The Council was invited to provide strategic advice to Highways England which was well received. Highways England reported back to the Council at a later date, having taken on board the comments received. Furthermore, the Council was approached by Highways England to attend workshops set up to better define their innovation strategy. The workshops were attended by Council members which demonstrates the impact across the wider Department agencies.

Council members have also been specifically requested to provide advice on topics that fall within their areas of expertise, as evidenced by the vehicle emissions project. This further demonstrates the value of the Council, and the access the Department has to academic experts. Council members have also called on their academic networks where needed. This is shown by the Centre of Smart Infrastructure and Construction at the University of Cambridge working together with the Council sub-group on the condition monitoring and intelligent infrastructure project.

11. Summary and Conclusions

The Council has clearly built on the momentum gained during its first year. Council members are more familiar with the main priority areas, and have advised on an extremely broad range of issues over the course of the two years. There is a clear impact of the Council in individual policy areas, and beyond into the wider Department agencies.

A number of examples can be cited where the Council has made an impact this year, such as advising on how the Department can help integrate remotely piloted aircrafts into UK airspace. The programme of work taken forward by the cross-government group working on this aligns with discussions at the Council meeting. The Council has also been instrumental in advising on the Energy Research Partnership project which is due to publish its findings shortly. Most notably, Highways England has frequently engaged with the Council beyond the initial Council meeting, and requested input from members at workshops set up to look at their innovation strategy.

This year also saw the Council drive the horizon scanning agenda for the Department. A Council meeting was crucial in identifying the right people to take part in a horizon scanning workshop. The subsequent SAC meeting then explored issues each member had identified in further detail.

Going forward, it is intended that the Council will play a key role in reviewing the Department's research programme and advising on the most effective ways of delivering it.

The Council now has a firm footing in the Department and over the coming year will seek to expand its interaction across DfT. Over the course of this period, the visibility with senior officials has increased with meetings between the Council's members, Permanent Secretary, Non-Executive Directors and Director Generals. However, there remains some scope to increase the Council's visibility within the Department and especially with Ministers.

Council members are always invited to bring key strategic science and engineering issues to the attention of the Department and provide strong challenge to the Department's science and technology work.

Overall, the Science Advisory Council has made good progress in its second year and continues to provide a valuable resource of strategic science and technology advice, however work needs to continue to ensure this resource is better utilised. Progress has already been made to address some of these issues by, for example, extending the length of Council meetings. Membership of the Council has also been increased, however there remains scope for additional experts to join from areas not currently represented.

Finally, with the likely recruitment of new members through a more formal route over the coming months, the status of the Council will change, and most likely bring in an update of its Terms of Reference.

Annex A – Biographies of Council members

Chair, Professor Lord Mair

Robert Mair is the Sir Kirby Laing Professor of Civil Engineering and Head of Civil and Environmental Engineering at Cambridge University. He was Master of Jesus College 2001-2011 and Senior Vice-President of the Royal Academy of Engineering 2008-2011. Before he was appointed to a Professorship at Cambridge in 1998 he worked in industry for 27 years, in 1983 founding the Geotechnical Consulting Group, an international consulting company based in London. He is engineering adviser to the Laing O'Rourke Group.

His research group at Cambridge specialises in the geotechnics of tunnelling and underground construction. He has advised on numerous tunnelling and major civil engineering projects in the UK and worldwide, including the Jubilee Line Extension project for London Underground. He introduced the technique of compensation grouting to the UK; this was successfully used to protect Big Ben from movement due to construction of the adjacent Westminster Station and the technique has now been adopted world-wide. He is closely involved with Crossrail, Europe's largest civil engineering project, and is a member of its Engineering Expert Panel. He gave evidence to the House of Commons and House of Lords Select Committees in connection with the Crossrail Bill.

Professor Mair also leads the Centre on Smart Infrastructure and Construction at Cambridge, involving the innovative use of the latest sensor technologies to monitor the behaviour of civil engineering infrastructure. He chaired the Royal Society/Royal Academy of Engineering Report on Shale Gas for the Government, published in 2012.

He was elected a Fellow of the Royal Society in 2007 and awarded the CBE in 2010 for services to Engineering. In October 2015, he was created an independent crossbench peer in the House of Lords.

Sue Duncan

Sue Duncan is an independent research consultant, with over thirty years' experience working in the public sector, at the centre of government in the Cabinet Office and Treasury, and in social policy departments, such as the Department for Work and Pensions, and Communities and Local Government.

While at the Cabinet Office, she worked in the Prime Minister's Strategy Unit and was Director of Policy Studies in the Centre for Management and Policy Studies, where she was responsible for good practice in policy making, research and evaluation and for evidence-based policy making. For much of her civil service career she was in the Government Social Research service (GSR), where she worked closely with senior civil servants and Ministers, providing research based advice and policy analysis to inform government decision making. Her career in government culminated in her appointment as the first ever Chief Government Social Researcher, responsible for the thousand or so social researchers working across government.

She has written and lectured widely on policy, research, research utilisation and evidence-based policy making. Publications include a book on the policy process under New Labour (Bochel & Duncan 2007) *Making policy in theory and practice* (Bristol: Policy Press), and articles in peer reviewed journals. She is a social scientist and has a BSc (Hons) from the University of Bath and an MA from the University of Sussex. She was a Visiting Professor at the University of Bristol and is now a Visiting Professor at the University of Lincoln; a Fellow of the Market Research Society; a Fellow of the Academy of Social Sciences; a member of the Social Research Association; an Honorary Fellow of Cardiff University and an Honorary Doctor of the University of Bath. She is also a past President of the Social Policy Association; a Trustee of the Stroke Association and Chair of its Research Strategy Committee.

Professor Barry Clarke

Barry Clarke, Past President of the Institution of Civil Engineers and Professor of Civil Engineering Geotechnics, is a founding Director of the Institute of Resilient Infrastructure at the University of Leeds. He is a Past President of the UK Engineering Professors Council; represents higher education on the Board of CITB ConstructionSkills, the training body for the UK construction industry; is chair of E4BE, a UK Construction Industry Council led body that focuses on the educational base of professionals working in the built environment; is a member of the Engineering Strategic Advisory Team of EPSRC, the research funding body for engineering research in the UK; and is Chairman of the Engineering Accreditation Board, a body that brings all the UK professional engineering bodies together to address the education of engineers.

Paul Stein

In his early career Paul Stein has held engineering roles with Philips, Thorn-EMI and Thales in the field of radio communications systems. In 1996 he was appointed Managing Director of Roke Manor Research, then a part of Siemens, which developed electronic and software systems as diverse as mobile phone design, automotive radar, internet routers and vision systems. Amongst its more famous developments are the software for the Western Extension Zone to the London congestion charge and 'Hawk-Eye', the highly successful ball-sport tracking system. In 2003 he was appointed to the Siemens UK Executive Management Board with special responsibilities for innovation and business strategy.

In 2006 he moved to the UK Ministry of Defence as the Director General, Science and Technology.

In 2010 Paul joined Rolls-Royce, the global power systems company, as the group Chief Scientific Officer and in 2016 was appointed Director – Research and Technology. Paul is responsible for the effective investment of Rolls-Royce Research and Technology expenditure, for shaping its innovation strategy and for promoting the technical specialist career path.

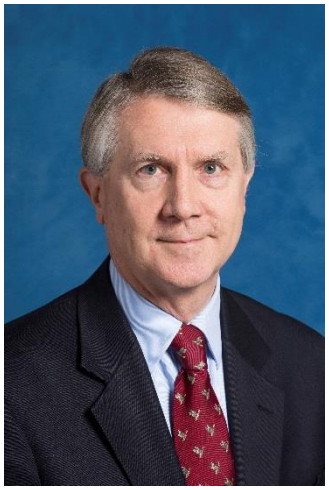
Paul is a Fellow of the Royal Academy of Engineering, a Fellow of the Royal Aeronautical Society and a Fellow of the Institution of Engineering and Technology.

Professor Paul Newman

Paul Newman is the BP Professor of Information Engineering at the University of Oxford and an EPSRC Leadership Fellow. He heads the Mobile Robotics Group within the Department of Engineering Science which enjoys a world leading reputation in mobile autonomy - developing machines and robots which map, navigate through, and understand their environments. His focus lies on pushing the boundaries of navigation and autonomy techniques in terms of both endurance and scale. He enjoys collaborations with many industrial partners (especially BAE, Nissan, BP, Guidance Ltd) which provide exploitation opportunities to drive the research. The group has developed a keen focus on intelligent transport.

He obtained an M.Eng. in Engineering Science from Oxford University, Balliol College in 1995. He then undertook a Ph.D. in autonomous navigation at the Australian Center for Field Robotics, University of Sydney, Australia. In 1999 he returned to the United Kingdom to work in the commercial sub-sea navigation industry. The navigation software he wrote then was used to repair the Deep Sea Horizon leak in 2010. In late 2000 he joined the Dept of Ocean Engineering at M.I.T. where as a post-doc and later a research scientist, he worked on algorithms and software for robust autonomous navigation for both land and sub-sea agents. In early 2003 he returned to Oxford as a Departmental Lecturer in Engineering Science before being appointed to a University Lectureship in Information Engineering and becoming a Fellow of New College in 2005, Professor of Engineering Science in 2010 and BP Professor of Information Engineering and Fellow of Keble College in 2012. He was elected a Fellow of the Royal Academy of Engineering in 2014.

Professor Peter Jones



Peter Jones is Professor of Transport and Sustainable Development, and Director of the Centre for Transport Studies at University College London. He is a member of the Independent Transport Commission and co-chairs the DfT's Joint Analysis Development Panel.

He has a wide range of transport research and teaching interests, covering both analytical methods and policy. These include traveller attitudes and

behaviour, travel trends and the determinants of travel demand, traffic restraint studies, accessibility studies, policy option generation, major transport economic and social impact studies, public engagement, development of new survey and appraisal methods, and advances in urban street planning and design.

Peter is a member of the Independent Transport Commission and the Transport for London Roads Task Force; he also chairs the West End Partnership's Transport Group. He was recently a member of the International Task Force for the Chinese 'Green Travel in Cities' initiative, and has carried out various advisory roles for the European Commission and for several national and city governments.

Professor Ricardo Martinez-Botas

Ricardo is Professor of Turbomachinery at Imperial College London, and Head of the Thermofluids Division in the Department of Mechanical Engineering.

He leads a research group in the area of low carbon vehicles with particular emphasis to highly downsized engines, turbochargers and energy storage systems. He has developed the area of unsteady flow aerodynamics of small turbines, with particular application to the turbocharger industry. The contributions to this area centre on the application of unsteady fluid mechanics, instrumentation development and computational methods. The work has attracted support not only from Government agencies but also from industry. His group has become a recognised centre of turbocharger turbine aerodynamics, and more particularly in the application experimental methods and one dimensional calculation procedures.

Ricardo has a MEng (Hons) Degree in Aeronautical Engineering from Imperial College London. He obtained a DPhil in the Rolls Royce University Technology Centre at the University of Oxford University in 1993. He was appointed Lecturer at Imperial College in 1994 and became Professor in 2012.

He is the current Chair UK University Internal Combustion Engines Group (UnICEG) and he is also vice-Chair of the American Society of Mechanical Engineers (ASME) Turbomachinery Committee. He is a Visiting Professor in the University Teknologi of Malaysia and at the Nanyang Technical University in Singapore. He has published over 85 journal papers. He is Associate Editor of the Journal of Turbomachinery (ASME) and the Journal of Mechanical Engineering Science (IMechE).

Professor Eddie Wilson

Eddie Wilson is Professor of Intelligent Transport Systems at the University of Bristol and head of the department of Engineering Mathematics. He is an applied mathematician and mathematical and computational modeller by training, with interests across a very wide range of application domains, but with a particular focus on transport; he has worked in highway traffic modelling. An especial interest has been on mathematics applied directly to industrial problem solving.

Current work of direct interest to the DfT involves advice to a DfT-sponsored project on use of mobile phone data in transport models (delivered via the Transport Systems Catapult), and an EPSRC project on using MOT data to estimate patterns in national mileage.

Annex B – Terms of Reference for DfT Science Advisory Council

1. Aim of Council

The SAC's primary aim is provide independent scientific and technical advice to DfT.

The provision of independent scientific and technical advice by the SAC will help to assist the DfT CSA to assure the quality and appropriateness of the Department's use of Science and Technology (S&T).

2. SAC Objectives

The objectives of the council are:

i. To advise the department on its systems, capability and processes for obtaining (S&T) advice that is fit for Departmental needs;

ii. To review the Department's strategic S&T priorities;

iii. To comment on key S&T risks, and contribute to horizon scanning capability;

iv. To reinforce links to national and international research community enabling DfT to get access to the best evidence;

v. To respond to *ad-hoc* requests for advice to support policy, where appropriate.

3. Responsibilities of the SAC Chair

i. The Chair is responsible for effective operational working of SAC and the delivery of SAC objectives, including the provision of high-quality timely advice.

ii. The Chair is responsible for ensuring the independence, objectivity and impartiality of the SAC.

iii. The Chair will report the SAC's advice to the DfT CSA including alerting DfT to new evidence likely to have an impact on current thinking; if appropriate the Chair could make representations to DfT DG's the DfT Permanent Secretary or the GCSA.

iv. The Chair is responsible for ensuring that the full range of scientific views (expressed by Council members) are appropriately taken into account during meetings and recorded in the minutes.

v. The Chair is responsible for representing the consensus of the membership; agreeing and summarising the decisions taken by the SAC and resolving any disagreements within the SAC.

vi. If the Chair is unable to continue in the role for any reason the Secretariat will consider and implement appropriate measures on a case by case basis.

SAC Chair Appointment and Rotation

Candidates for the SAC Chair will be nominated from learned societies and professional institutions. From this short list the DfT CSA, in consultation with the SAC secretariat and senior DfT colleagues, will make a recommendation to ministers for the position of SAC Chair.

If approved by ministers an invitation will be sent to the selected candidate.

If the Chair should step down the DfT CSA and SAC Secretariat will decide on succession planning, taking advice from the SAC membership. The selection process will likely follow similar steps as set out above

SAC Appointment and Process for Filling Expertise Gaps in SAC

The SAC would consist of approximately 6-8 members made up of mixture of senior academics and industries representatives. The members would be drawn from a mix of transport and non-transport domains, with a focus on candidates who can take a strategic view of Departmental issues. Candidates will be nominated from the learned academies, professional institutions and societies and selected using the criteria below:

- Independently Minded and Intellectually Neutral[4]
- Expertise, Skills and Experience
- Seniority and International Reputation
- Familiarity with Government Processes and Key Polices
- Promotion of Fair and Independent Process

Candidate nominations will be sent to the Chair and DfT CSA, who will agree the final short list. A small panel led by the Chair and including the DfT CSA will then make a final selection with agreement from Ministers. An invitation letter from the Chair and CSA will be sent to the selected candidates.

SAC Membership

SAC members are expected to commit to the process for a minimum of two years.

[4] Self-aware, curious, independent, interest in areas wider than individual disciplinary expertise.

The Chair, together with the DfT CSA and SAC Secretariat will regularly review the balance of skills, expertise, and experience of the SAC - in light of both current and anticipated future departmental needs and priorities.

The Chair, together with the DfT CSA and SAC Secretariat will actively plan for SAC succession with the membership's input.

4. Responsibilities of the SAC Secretariat

i. The SAC Secretariat will assemble, analyse and record conclusions of meetings; the records of the meetings will include a summary of the key SAC discussions and the Chair's summary.

ii. SAC minutes will be published on Transnet/DfT Website (once ratified by the SAC) and recorded unattributably. If a SAC member wishes to have a comment made attributably, this can be undertaken.

iii. The SAC Secretariat will provide impartial independent support to the SAC Chair and arrange appropriate briefings.

iv. The SAC Secretariat will agree the agenda of meetings with the Chair and DfT CSA.

v. The SAC Secretariat will generate and disseminate papers to members ahead of each meeting.

5. Responsibilities of the SAC Members

i. Members are expected to abide by the seven principles of public life (Nolan Principles – see below)

ii. SAC members and the Chair should take note of the GCSA's *Guidelines on the Use of Science and Engineering Advice in Policy Making* and the GCSA's *Principles of Scientific Advice to Government* (details below).

http://www.bis.gov.uk/assets/goscience/docs/g/10-669-gcsa-guidelines-scientific-engineering-advice-policy-making.pdf

http://www.bis.gov.uk/go-science/principles-of-scientific-advice-to-government

iii. These papers will help the SAC to understand how science advice is taken up with departmental officials. Any issues should be discussed with the SAC Secretariat.

iv. Members should ensure they understand why they are being appointed to the SAC and in what capacity.

v. All members should share in the general responsibility to consider the wider context in which their expertise is deployed.

vi. Members should confirm before accepting an invitation to serve on the SAC that they are clear about the period of the appointment and that they can fulfil the commitment required in terms of appointment, meeting attendance, SAC business and preparation for meetings.

vii. All members are responsible for ensuring the independence, objectivity and impartiality of the SAC; individuals appointed to the SAC should not act as representatives for their particular profession, employer or interest group, and have the duty to act in the public interest.

viii. Any changes to the role/function of individual members on the SAC must be agreed with the Chair and DfT CSA.

ix. Members' role on the SAC should not be circumscribed by the expertise or perspectives he/she was asked to bring to the Group. Members should regard themselves as free and encouraged to question and comment on the information provided or the views expressed by any of the other members; notwithstanding that the views or information do not relate to their own area of expertise.

x. Members can raise any concerns in regard to the SAC with the Chair or SAC Secretariat.

6. SAC Ways of Working

i. DfT CSA will inform SAC of DfT's research agenda and the strategic direction of and priorities for departmental science.

ii. SAC will report via the Chair to the DfT CSA.

iii. SAC will meet 4 times per year.

iv. The Council will be supported by a wider network of Subject Matter Experts that would be able to provide more focussed advice on specific issues.

v. The SAC will provide an annual report to the Permanent Secretary and Ministers. It may also provide specific reports on ad-hoc issues as required.

vi. Declaration of Interests must be provided and signed by all SAC members (including the Chair) and updated as appropriate and as circumstances change. The Register will be held by DfT only. Any issues should be discussed with the SAC Secretariat.

vii. SAC members generously provide their time and expertise in-kind, no honorarium is provided. DfT will reimburse all reasonable travel and

incidental expense. In compliance with HMG guidelines, no first class travel can be undertaken for DfT business.

Seven Principles of Public Life '*Nolan Principles'*

1. Selflessness

Holders of public office should act solely in terms of the public interest. They should not do so in order to gain financial or other benefits for themselves, their family or their friends.

2. Integrity

Holders of public office should not place themselves under any financial or other obligation to outside individuals or organisations that might seek to influence them in the performance of their official duties.

3. Objectivity

In carrying out public business, including making public appointments, awarding contracts, or recommending individuals for rewards and benefits, holders of public office should make choices on merit.

4. Accountability

Holders of public office are accountable for their decisions and actions to the public and must submit themselves to whatever scrutiny is appropriate to their office.

5. Openness

Holders of public office should be as open as possible about all the decisions and actions that they take. They should give reasons for their decisions and restrict information only when the wider public interest clearly demands.

6. Honesty

Holders of public office have a duty to declare any private interests relating to their public duties and to take steps to resolve any conflicts arising in a way that protects the public interest.

7. Leadership

Holders of public office should promote and support these principles by leadership and example.