

**Department for Transport
Department for Business, Energy, Innovation and Skills
Response to House of Lords Science and Technology Select Committee report**

**“Connected and Autonomous Vehicles: The future?”
2nd Report of Session 2016–17**

Government Response

The Department for Transport and Department for Business, Energy and Industrial Strategy welcome the report of the House of Lords Science & Technology Committee on the use of automated vehicles in the UK. This document sets out the government’s response to the recommendations made by the committee.

Through our Industrial Strategy, we are investing jointly with industry in both research and development and the development of testing environments to ensure that the UK remains at the forefront of the development of this technology.

The UK has the potential to be a global leader in the development and deployment of automated technologies, building on our heritage as a nation of innovators and entrepreneurs and utilising our existing centres of excellence across numerous sectors.

We are actively collaborating with industry, academia and others to understand where the UK can and should focus its efforts to secure sustainable economic and social benefits from these revolutionary technologies and map out the steps we need to take to ensure a policy framework that helps achieves this ambition.

Recommendation 1: Autonomous vehicles are being used, or have the potential to be used, in the roads, marine, agricultural and other sectors. But there is no clear central coordination of strategy or information sharing across the different sectors. The Government must broaden its focus so that its work on connected and autonomous vehicles (CAV) cuts across all sectors and does not focus so heavily on road vehicles. This will require greater coordination across Government and the involvement of more departments in the work of the Centre for Connected and Autonomous Vehicles (CCAV).

Response: The Government agrees that work in this field should be coordinated. Automation offers potential benefits throughout the whole UK economy, and the Government is taking action to help different sectors learn from each other. CCAV works with a large range of stakeholders, and is exploring ways to foster cross-sectoral learning. An example is the most recent CCAV R&D competition, which was opened to include off-road vehicles.

Through our Industrial Strategy we are also keen to help support the emergence of new sectors, including nurturing the development of an artificial intelligence sector in the UK. This will rely on strong business leadership. This is why Government has developed an offer of a new “sector deals” approach driven by the interests of firms and the people they employ, to address sector-specific challenges and opportunities. This approach will ensure that Government and industry are able to work together to

promote emerging technologies and business models to help make the UK a world leader in the adoption of disruptive technologies.

Recommendation 2: Whilst we note that the Government will revisit the idea of a RAS Leadership Council through the process of the Industrial Strategy, action to coordinate activities across the robotics sector, including CAV, is more urgent than this timescale would suggest. We call on the Government to establish such a Council as soon as possible, to ensure that technology and expertise is shared and the maximum economic benefit for the UK is achieved.

The RAS Leadership Council must take the lead in this area and the Government should complement the work of this Council by taking action only in areas where the RAS Leadership Council advises it that Government action is required or where the Leadership Council is not acting.

Response: In February this year the Secretary of State for Business, Energy and Industrial Strategy invited the Robotics and Autonomous Systems (RAS) community, represented by Brian Holliday of Siemens and Professor David Lane CBE from Heriot Watt University, to come forward with a sector deal. By acting as RAS sector co-leads they will provide strategic leadership across the full breadth of the robotics and autonomous systems sector in the UK as they work on a RAS Sector Deal. In doing this, they will bring together industry with the research base to form a RAS Sector Council that will ensure future RAS activity addresses any strategic coordination challenges that arise as the technology emerges.

Recommendation 3: We agree with the House of Commons Transport Committee that the Government has not implemented a coherent, joined up transport strategy. We recommend that the Government should bring forward a wider transport strategy that places the development and implementation of CAV in the context of wider policy goals, such as increased use of public transport, and the reduction of congestion and pollution.

Response: The Government recently published (in July 2017) a Transport Investment Strategy, which describes what we are trying to achieve through our investment in transport infrastructure, the priorities and propositions that will guide future investment decisions, as well as the actions we are taking to help meet our ambitions.

Alongside this Investment Strategy and the Department's Single Departmental Plan, there are also a number of strategic papers relating to specific areas of policy, including; the strategic case for HS2; the Road Investment Strategy; the National Networks National Policy Statement; and the National Infrastructure Delivery Plan. We have also published The Pathway to Driverless Cars: a detailed review of regulations for automated vehicle technologies and the subsequent Code of Practice for testing automated vehicles on public roads.

These documents are intended to be short and accessible and whilst not a comprehensive survey of everything the Department for Transport does, they provide a clear narrative about the significant level of future investment that will help the government deliver its policy goals. These documents highlight the importance

the Government places on long term strategy and planning, and as our work on CAVs matures we will continue to set this in the context of the Government's wider policy aims for the future of transport.

Recommendation 4: The Government must continue to engage with the insurance industry and other stakeholders to ensure that proposals to protect victims where an autonomous vehicle is involved in a crash while in automated mode are workable, timely and appropriate. The Vehicle Technology and Aviation Bill is unlikely to receive Royal Assent in the current Parliamentary session therefore the Government should stand ready to reintroduce the Bill in the next Parliamentary session.

Response: Protecting the public is at the heart of what we are doing. While we fully expect that the continued increase of automation in vehicles will reduce the number and severity of collisions, we are actively working to make sure that the victims of any collision involving an automated vehicle have quick and easy access to compensation in line with existing insurance practice. We are now taking forward the automated vehicle insurance measures in the Automated and Electric Vehicles Bill, introduced into Parliament on the 18th October¹ to make sure that the necessary legislative requirements are in place.

We recognise that we will need to do more than just making new legislation. We are working closely with our motoring agencies, the insurance industry, and the automotive industry to deliver an insurance framework that is fit for a future with automated vehicles.

Recommendation 5: Local Transport Authorities (LTAs) are responsible for the vast majority of UK roads and, together with the Traffic Commissioners for Great Britain, need training, briefing and guidance on standards for the roads sector relating to the deployment of CAV. LTAs must also be able to pool resources in order to minimise duplication of work and maximise potential benefits of CAV.

We recommend that the Government should set up and chair a forum that will allow LTAs to share knowledge and expertise on CAV and to be involved as advisers on the direction of future trials and research.

Response: The Government agrees with the recommendation that Local Transport Authorities will play an integral role in the success of connected and autonomous vehicles, and that the Government can help to facilitate learning and sharing of experiences as the technologies develop. We engage with Local Transport Authorities frequently, and recently we have initiated a series of meetings to provide a forum for local authorities deploying or interested in deploying connecting vehicle technologies to share knowledge and expertise in this area. We hosted the first of these events in Newcastle on 24 May. A further meeting is being scheduled for this Autumn.

¹ <https://services.parliament.uk/bills/2017-19/automatedandelectricvehicles.html>

Recommendation 6: The Government must continue to take action to close the engineering and digital skills gap to ensure that the UK can benefit from the emerging CAV technologies. We welcome the focus on skills in the Government's Industrial Strategy Green Paper and urge the Government to find innovative solutions to this problem. These might include provisions such as those proposed in the Higher Education and Research Bill which aim to make it simpler and quicker for innovative and specialist providers to set up, award degrees and compete alongside existing institutions.

Response: The Government agrees with the Committee's focus on skills as a key enabler for UK success in new technologies, something we recognise in our Industrial Strategy. For connected and autonomous vehicles this will require focus in a wide range of different technical disciplines, from vehicle and infrastructure engineering through to digital technologies. For instance, the industry led Automotive Council has played a pivotal role in addressing skills challenges in the sector and this work is increasingly focusing on the skills requirements of connected and autonomous vehicles. Among other initiatives, it has overseen the development and testing of trailblazer apprenticeships, targeting these where there are critical skills gaps and helping to ensure a coherent approach overall, coordinated with other sectors. The Automotive Council is also working to understand the skills required to build competitiveness in different regions – including looking at specific job roles, qualifications and training provision.

The UK's supply of specialist skills scores well above the EU average², but to keep ahead we will have to keep improving as the digital economy grows and demand for specialist skills increases. We are taking action across the education and training pipeline to enable us to respond positively to emerging technologies. This ranges from ensuring our school computing curriculum provides young people with the knowledge and skills needed for the future world of work, through to establishing new institutions to train students in digital skills and embedding digital skills in technical education. Building on this, we will be taking forward recommendations made in May 2016 within Sir Nigel Shadbolt's report on Computer Science degree courses and graduate employability issues in this area.

In addition, the Strategic Transport Apprenticeship Taskforce (STAT) was established in April 2016 to deliver on the ambition of the Transport Infrastructure Skills Strategy – to create more apprenticeships, improve diversity and promote transport as a career. We expect increases in the number of apprentices as more contracts move to award and the Apprenticeship Levy drives investment further. STAT also developed the most detailed skills forecasting tool that the transport industry has ever had to improve understanding of the skills we need in the future. It shows where skills are needed in terms of both geography and discipline and that we need higher level skills, including in emerging disciplines like cyber security and digital signalling, and a steady pipeline of workers at operative level. STAT is using the model to develop its work programme.

Recommendation 7: CAV have the potential to increase accessibility and mobility for those less mobile or those unable to use traditional vehicles, such

² <https://www.gov.uk/government/publications/uk-digital-strategy/2-digital-skills-and-inclusion-giving-everyone-access-to-the-digital-skills-they-need#fn:3>

as the elderly or disabled. However, they may not be suitable for some people with mobility problems, if, for example, they are unable to get into or out of a car without help. Furthermore, these benefits will only be realised with full automation and if the vehicles are both affordable and acceptable to prospective users

Response: We welcome the Committee's observation that CAV technologies have the potential to increase accessibility, mobility and enhance quality of life for vulnerable members of society.

A significant driver for CCAV's involvement in research, development, trials, and demonstration is to engage the public and understand how people will use these technologies. This will provide valuable information for policymaking, costs and benefits evidence and market information for current and potential future investors. Accessible vehicles are a clear potential market for this technology. Our programme of research and development jointly funded by government and industry includes projects that will explore the benefits to those with limited mobility options and will produce invaluable insights in this area. For example, the INSIGHT project is developing driverless shuttles with a particular focus on improving urban accessibility for disabled and visually-impaired people. The FLOURISH project will help develop innovative new tools to improve the understanding of user needs and expectations of connected and autonomous vehicles and includes Age UK as a member of the consortia.

Recommendation 8: CAV have the potential to lower the number of road fatalities. But the eradication, or near eradication, of human error will only be realised with full automation. CAVs are not the only way to reduce road casualties. There are other means by which to achieve this and we urge the Government not to lose sight of these other possibilities

Response: The Government recognises the potential for CAVs to reduce the number of collisions on our road as they can reduce the impact of human error on road traffic collisions. This is a major factor behind our decision to facilitate the development and deployment of CAVs. But we are not complacent and we recognise that there are other measures that contribute towards reducing road deaths and casualties. The Government's Road Safety Statement³ sets out the priorities for improving the safety of Britain's roads including around 50 key actions. We have already implemented some of those-for example;

- Higher penalties for those using a handheld mobile phone whilst driving came into force on the 1st of March.
- We have piloted a new practical driving test to better reflect real life driving situations and consulted on allowing learner drivers to take lessons on motorways with an approved driving instructor.
- We have developed a £2m research programme to test the effectiveness of a range of measures, including telematics to improve the safety of young and novice drivers.

³ <https://www.gov.uk/government/publications/road-safety-statement-working-together-to-build-a-safer-road-system>

Another initiative following the Autumn Statement is to allocate £175m to help improve the safety of the 50 highest risk 'A' road sections in England based on analysis by the Road Safety Foundation. The fund is specifically for delivering road upgrades to reduce the number and severity of fatal and serious injury collisions.

Recommendation 9: Our evidence indicates that platooning of trucks could be an early example of CAV deployment on roads and the Government should ensure that it carries out an early evaluation of the potential applications of connected and autonomous larger vehicles used for freight and logistics. The Government must ensure that a clear business case for platooning—and indeed for any CAV application—has been made before significant investment is made.

Response: An earlier study commissioned by the DfT found that HGV platooning was technically feasible on UK roads and the DfT is now working with Highways England to deliver a joint research programme to gather evidence to help us understand the effects on road safety, the economy, the environment, and traffic congestion, given the UK's unique conditions and infrastructure. A consortium, led by the Transport Research Laboratory, is taking forward an HGV platooning pilot.

Recommendation 10: The theoretical potential of CAV to reduce traffic congestion varies depending on the level of vehicle autonomy and the penetration rate. While we cannot say with any certainty what the impact on congestion will be, it is possible to imagine a situation of total gridlock as CAVs crawl around city centres. It is important that the right policy decisions relating to CAV are made in order to reduce the likelihood of this occurring.

Response: The effect of CAVs on congestion is uncertain. Congestion is a function of the capacity and performance of the road network, and the level of demand in a certain place at a certain time.

We have begun to address questions about the potential impacts of CAVs on the capacity and performance of the road network, for example, through the traffic flow impacts study which the Committee saw as part of its evidence. We have also completed a further study on the impacts on network performance of the potential improvements to road safety of CAV technologies.

These studies were conducted under conditions of a fixed level of demand. As for the impact of CAV technologies on the level of demand, the potential impacts are very complex and further research is needed in order to understand the possible impacts on congestion and what policies may be required to manage these effects. DfT is engaging in research to address these issues.

Recommendation 11: Whilst some of our evidence has suggested that CAV could have huge economic benefits, we are not convinced that the statistics provided have been properly substantiated.

Response: Assessing the impacts and value of CAV technology is inherently uncertain. Evidence seen by the Committee would have included expert opinion and

analysis based on numerous assumptions. The impacts of CAV technology will depend on a broad range of uncertain factors, and any forecast should be treated in the context in which it is presented and with the assumptions used to generate it in mind. Nevertheless, there is a place for such forecasts in assessing the potential for the technology to create social and economic value, and beginning to understand the role for government in achieving this.

Recommendation 12: We recommend that the Government should commission a detailed cost-benefit analysis to provide a realistic indication of the economic benefits CAV could provide in all sectors, differentiating clearly between the different applications of CAV, actual monetary gains from deployment, estimated job creation and social benefits. This will help the Government decide where the focus of its efforts should be.

Response: The Government is engaged in a broad programme of research, development, demonstration and analysis, which together is contributing to our understanding of the technology and the evidence base on which to generate policy. This approach includes identifying specific questions and strategically targeting research in areas where we need to develop the evidence base in order to inform policy.

For example, we have recently published a forecast of the core economic impacts of CAV technology development and production in the UK, by estimating the potential size of the domestic and global market and the share of this that the UK could capture under different scenarios. The report focusses on the core economic impacts of CAV development and production, in terms of jobs and gross value added, and helps government and industry understand not only the size of the market we are competing for a share of, but the areas of CAV production we are best placed to capture. We plan to build on this to better understand the impact on vehicle production of new mobility business models and the potential for the UK to capture value in the provision of new mobility services. Future research will include looking into specific potential economic benefits that flow from the adoption of the technology.

It would not be productive to commission an overall cost-benefit analysis of CAV technologies at this point in time, as there would not be sufficient information to produce a realistic, meaningful or robust indication of the economic benefits CAV could provide.

Recommendation 13: It is unclear whether CAV will lead to job creation or job losses overall. The cost benefit analysis that we have recommended should include detailed consideration of the impact of CAV on jobs; specifically whether this will include job losses, job creation or job shifts.

Response: The Government recognises the importance of understanding where CAVs could create jobs as well as the impact of CAVs and autonomous systems in the economy more generally. We have conducted analysis of the opportunity of CAV technologies for UK industry, including the potential size and value of the UK and global markets for CAVs and CAV technologies, and the potential for job creation in

their development and production. We also plan to conduct further analysis of the potential impacts of CAVs on jobs in transport industries.

Recommendation 14: There is little hard evidence to substantiate the potential benefits and disadvantages of CAV because most of them are at a prototype or testing stage. Furthermore, as with any new technology or advancements, there may be unforeseen benefits or disadvantages that have not yet presented themselves.

Response: To reiterate our responses to Recommendations No 11 and 12, assessing the impacts and value of CAV technology is inherently uncertain, and one of the reasons for this is lack of empirical evidence on which to conduct analysis. It is important we develop the evidence base around the full range of possible impacts of the technology to support policy making. Our sponsorship of research, development and demonstration contributes towards this evidence base.

Recommendation 15: Nonetheless, the UK's ambition should be to take the lead with CAV in areas where a business case can be made which shows a clear early advantage accruing to the UK.

Response: The Government agrees with this recommendation. We have already conducted analysis of the CAV value chain with EY, Transport Systems Catapult, and Innovate UK, building on the earlier Traveller Needs and Capability Study. This analysis was concluded in July 2017 and has determined that no country can claim leadership in all areas of this rapidly evolving sector, so the UK is choosing to focus resources on consolidating leadership in a few areas (testing and development, connectivity solutions, data & cyber security, and new business models), securing new high quality jobs and businesses, and unlocking vital social benefits. CCAV is now working with industry to map out the policy requirements to support this ambition.

Recommendation 16: In considering the necessary future research it is important that the Government plays to the UK's strengths and that the research is not carried out, commissioned or funded by the Government where it is better carried out by industry or other stakeholders. The Government should not need to invest or take the lead in development of autonomous cars—this is best left to industry. However, the Government should continue to invest in the fundamental scientific research in robotics and information technology that underpins autonomous cars and other CAV, and also the social, human factors and network management problems that must be understood for deployment.

Response: Part of a modern industrial strategy means working in partnership with industry to ensure the UK is competitive now and into the future through jointly investing in the right skills, research and infrastructure. The Government's work in CAVs stems from a high level dialogue with the UK automotive industry, and emerging players, to understand where the UK can be world leading.

By establishing the Centre for Connected and Autonomous Vehicles, the Government has taken the conscious decision to accelerate development of the technologies so the UK can position itself at the forefront of this emerging market. The Government provide R&D funding to mitigate the risks and market failures inherent in early stage technologies - catalysing development and attracting inward investment.

The Government will continue to invest in fundamental scientific research; at the Autumn Statement ⁴last November, the Government announced a new £4.7 billion investment over four years to enhance the UK's position as a world leader in science and innovation. This is in addition to the £26.3bn committed to science funding at the 2015 spending review over the 2016/17-2020/21 period

Recommendation 17: We are disappointed that the Government has delayed making a decision on a new flagship test facility. A delay is particularly damaging because CAV development is a fast moving area.

The Government must put together a comprehensive testing and research offer for CAV to attract manufacturers and academics to the UK immediately. This should include one or more large scale testing environments covering real world urban and rural environments.

Response: The Government disagrees that it has delayed a decision on a testing facility – it has consulted with industry and academia to gather evidence to where and how to make the best investment. Last summer, CCAV issued a “Call for Evidence⁵ on the UK Testing Ecosystem for Connected and Autonomous Vehicles”. Rather than favouring a single facility, the call found broad industry and academic support for the UK doing something that would be genuinely distinctive by strengthening and coordinating our existing world class assets more effectively, capitalising on our competitive advantage of being able to test anywhere in the UK today, as set out in our Code of Practice.⁶ This approach would be faster, supporting UK competitive advantage, and provide greater value for money for the public purse than a new facility. The Government's response⁷ to the Call for Evidence was published in March 2017.

The evidence gathered through this consultation informed an Autumn Statement 2016 announcement of £100 million for new CAV testing infrastructure. This funding will be matched by industry and focused on projects upgrading existing testing capabilities and creating new ones through an open process. The competition winners of the first £51m phase of this funding, four consortia led by HORIBA MIRA, Millbrook Proving Ground, TRL and The Warwick Manufacturing Group were announced⁸ on 19 October. These projects will test the speed, safety and potential

⁴https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/571559/autumn_statement_2016_web.pdf

⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526148/bis-16-274-ccav-uk-testing-ecosystem.pdf

⁶ <https://www.gov.uk/government/publications/automated-vehicle-technologies-testing-code-of-practice>

⁷ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/603887/connected-autonomous-vehicles-uk-testing-ecosystem-government-response.pdf

⁸ <https://www.gov.uk/government/news/winners-of-51-million-government-competition-to-develop-world-leading-self-driving-car-testing-infrastructure-unveiled>

opportunities for delivering CAV innovation, helping to ensure the UK remains world leading. A new coordination hub for this activity called MERIDIAN⁹, split between London and Coventry, was announced on 7 September.

Recommendation 18: CAV could have negative implications for drivers' competence, making drivers complacent and overly reliant on technology. This is of particular concern in emergency situations, where a driver may react slowly to taking back control of a vehicle. It may be the case that for Level 3 vehicles the risks will be too great to tolerate. The risk of complacency also extends to other road-users who will interact with CAV, such as pedestrians and cyclists. Further research is necessary to understand these risks, including possible measures to address them.

Response: There is a potential risk that driver attentiveness may be degraded in so-called "Level 3" vehicles, and this is receiving consideration within the United Nations Economic Commission for Europe where the international standards for automated functionality of road vehicles are being developed; the UK is actively engaged in these discussions. Once developed, it will be the responsibility of developers and manufacturers to ensure automated driving functions comply with those standards. We will be better positioned to understand any risks that remain and, if necessary, to undertake further research to support policy decisions regarding the use of the technology. Our domestic regulatory programme is geared to permit adaptation of specific requirements to support the safe deployment and use of automated vehicles.

A literature review undertaken as part of the social and behavioural scoping study on the key social and behavioural questions associated with connected and autonomous vehicles shows that the interaction of the vehicles with the driver and other road users, including pedestrians and cyclists is an under-researched area, with most focus being given to the technical aspects.

Further research is being undertaken to understand driver dis-engagement during automated driving control and the risks to safety during the transition to conventional driver control of the vehicle. This project will support and inform the DfT in the development of policy for future standards, and is due to report by the end of the year.

Recommendation 19: We recommend that the Government should give priority to commissioning work to understand the main social and behavioural questions relating to CAV, in particular answering those questions identified by its own scoping study. This work should build on international research in this area. Furthermore Innovate UK and Government departments should ensure that studying behavioural aspects is an integral part of trials they fund, including access to simulation facilities if necessary.

⁹ <https://www.gov.uk/government/news/government-launches-meridian-to-accelerate-connected-autonomous-vehicle-technology-development-in-the-uk>

Response: The Government agrees with this recommendation and is pleased that the Committee recognises the importance of social and behavioural research relating to CAVs. We also agree that commissioning work to understand the main social and behavioural aspects of CAVs is a priority. This is why we commissioned the scoping study on the key social and behavioural questions associated with connected and autonomous vehicles. The report¹⁰ provides a number of research recommendations for future social and behavioural research not just for Government but the entire CAV sector to engage with. Following on from this, we are currently planning the next steps for further research which will include identifying rigorous research options to understand the attitudes of the wider public. Any research we undertake will build on existing research in this area, both in the UK and internationally. The existing evidence gaps cannot be filled by Government alone; therefore, we encourage contributions on the social and behavioural evidence from academia, industry and other stakeholders.

The Government is also being proactive in fostering collaboration in the social and behavioural research area on CAVs. We have organised a one-day 'symposium' which will bring key people from academia and industry together to discuss how they might work more effectively with one another, with the objective of creating a social and behavioural research 'community'. This will help ensure that social and behavioural research is being undertaken effectively, not only by government but also by other important stakeholders from academia and industry.

Recommendation 20: We welcome the modelling work commissioned by the Government. This should be a starting point for further work on mixed fleet modelling to inform policy development. This work should help to counter the possible disadvantages and negative effects of managing a mixed fleet of autonomous and non-autonomous vehicles. The research on human factors must feed in to the modelling work so that as more is understood about human interactions with CAV, the modelling work can be refined to give more accurate results.

Response: The Department welcomes the views of the Committee and recognises the importance of studying mixed fleet management and accounting for human factors. The research referred to by the Committee was conducted in 2015/16 and focused on the impact of changed vehicle behaviour on traffic flow and road capacity¹¹.

We have expanded the work in 2016/17 to examine the potential impact of connected and autonomous vehicles on road safety, and how this may in turn affect road network performance. The new project also involves a modelling exercise to explore how road space might be managed differently to take better advantage of connected and autonomous vehicles. We expect these analyses to be concluded shortly.

¹⁰ <https://www.gov.uk/government/publications/social-and-behavioural-questions-associated-with-automated-vehicles>

¹¹ <https://www.gov.uk/government/publications/driverless-vehicles-impacts-on-traffic-flow>

Recommendation 21: We were surprised that the work the Government has commissioned on micro-scale modelling was not more widely known by our witnesses. The Government should take steps to ensure future work in this area is more prominently planned and shared with stakeholders including LTAs.

Response: The Department co-presented CAV impacts findings along with our consultants at a CIHT-hosted seminar in February this year, at the Traffex Conference at the NEC in Birmingham in April, and at the ITS European Congress in June. We will look for further opportunities to disseminate this and any future research in this field commissioned by the Government.

Recommendation 22: The potential for improved crop production and reduced adverse impacts on the environment by the use of CAV in agriculture is considerable. The Government should fund appropriate R&D once a business case is made which demonstrates the advantages which will accrue.

Response: The Government acknowledges the role that Connected and Autonomous Vehicles can play in improving the production and efficiencies within the agricultural sector.

Through our Agri-Tech Strategy £160 million was committed to be co-invested with industry and address challenges in the agri-tech sector. As part of this, £80 million has been invested in four Centres for Agricultural Innovation to support the wide scale adoption of innovation and technology, developing skills and capability in the food and farming supply chain. One of these centres – the Agricultural Engineering Precision Innovation Centre (Agri-EPI) – will focus on research and development related to a broad range of engineering and precision agriculture technologies. £70 million has also been allocated to Agri-Tech Catalyst projects, one of which is focussed on 3D camera technology and broccoli harvesting. This will provide a key underpinning step towards the development of a fully automatic and camera guided robotic harvesting system for broccoli. Whilst we understand that much of the technology remains at an early stage in its development, we do recognise the significant potential for increasing the productivity of businesses in the longer term.

Future R&D needs will be identified through the Government's planned engagement with the sector through the Industrial Strategy green paper consultation and the Industrial Strategy Challenge Fund.

Recommendation 23: We recommend that funding is allocated for cybersecurity of CAV through the upcoming Cyber Science and Technology Strategy. Cybersecurity should also form an integral part of the Government's review of the regulatory framework for CAV.

Response: As part of delivering the overall National Cyber Security Strategy, the Government has allocated £1.9 billion of transformational investment in cyber security through the National Cyber Security Programme.

The Government's Interim Cyber Security Science and Technology Strategy does not allocate funding. It outlines a proposed new approach to ensure that the cyber

security risks and opportunities arising from new and emerging technologies are properly considered in departmental policy making. This includes an ongoing role for the National Cyber Security Centre in horizon scanning (as the National Technical Authority on cyber security). The interim strategy has identified connected and autonomous vehicles as an important emerging technology, with significant potential social and economic benefits through enhanced safety, productivity, efficiency and accessibility.

We have published a set of principles for cyber security of vehicles¹² and are pressing for internationally harmonised guidance. Alongside this, we are reviewing other measures to ensure vehicles are secure over their lifetime, such as standards and consumer information. There is already a comprehensive regulatory framework for personal data, which covers personal data generated by vehicles, and we are reviewing the full range of data generated and processed by the CAV ecosystem and what governance may be required.

Recommendation 24: The Centre for Connected and Autonomous Vehicles (CCAV) is well placed to take a coordinating role with regard to cybersecurity for CAV. It should involve the newly established National Cyber Security Centre in this work as well as external stakeholders and experts.

Response: We are taking a holistic approach to addressing the full range of security issues in relation to the CAV ecosystem. We are therefore already working closely with the National Cyber Security Centre and the Centre for the Protection of National Infrastructure, along with other government and external stakeholders.

Recommendation 25: An international effort is necessary to tackle the risks associated with cybersecurity, which are likely to rise—especially on a global scale—as the use of CAV increases. The Government could lead on this, in order to facilitate the establishment of global standards.

Response: We recognise the importance of engaging internationally and can confirm that we are already influencing the international discourse at the highest levels, including chairing a technical working group at UNECE looking at cyber security and “over the air” updates. The UK is in a strong position to influence this work.

Recommendation 26: Highways England and Local Transport Authorities should jointly engage with the industry to examine the potential for ensuring that new infrastructure can be futureproofed and does not need expensive retro-fitting.

Response: Connected and autonomous vehicles will require improved digital infrastructure, and this may change or develop over time. We are investing in research and development projects to understand what the optimal deployment for digital infrastructure will be now and in the future. We have committed £15m to

¹² <https://www.gov.uk/government/publications/principles-of-cyber-security-for-connected-and-automated-vehicles>

develop a flagship Connected Corridor along the A2/M2. Linking with Europe, this corridor will test a variety of communication infrastructure, allowing flexibility depending on the demands of industry and understanding the uncertainty presented at this stage.

Recommendation 27: The Government must take action with Highways England to improve digital connectivity, removing ‘not-spots’ on British roads—in particular on the strategic road network—in order to realise the benefits of connected vehicles, which, according to the European Commission, are likely to become available in the next three years. This can be done through the Digital Economy Bill and the implementation of the Universal Service Obligation to create a ubiquitous digital network. It will also require work at an international level to ensure the development of international standards relating to connected vehicles.

Response: The National Infrastructure Commission highlighted the importance of improving the UK’s digital infrastructure on the road network, which will increase in importance with the growth of Connected Vehicles. The UK’s 5G strategy confirmed that we will work with industry to assess the potential for commercial provision of telecommunications services on road networks, and how new and existing infrastructure can be used to support them. We will report back to the National Infrastructure Commission by the end of 2017.

Recommendation 28: It is essential that any data gathered from CAV are used in accordance with data protection law. We welcome the fact that the Information Commissioner’s Office (ICO) has undertaken initial work with vehicle manufacturers, and is launching its own call for evidence.

Response: We welcome the ICO’s initial work in this area and we are developing policy on CAV data with them and other stakeholders. Data protection, security and fair market access are essential to the functioning of the CAV ecosystem and consumer trust. There is a live debate about governance and access of vehicle data and we are engaging stakeholders with an interest in this matter to ensure our policy position reflects their views.

Recommendation 29: However, the meaning of personal data is unclear in the context of CAV. It will be important to achieve privacy for individuals and communities, while using data to achieve efficiency and safety of CAV operations. Data relating to an individual’s CAV in terms of position, speed and performance on the road cannot be regarded as entirely personal—such data is needed for public benefit if a CAV system is to operate as a whole. Good data governance will therefore be needed to secure appropriate protection of personal information while safely using and linking open and non-sensitive data. Distinctions will need to be made between commercially sensitive data owned by technology providers and open data.

Response: Any data that can be attributed to an individual, either directly or indirectly, should be classified as personal data. There is a live debate ongoing

about how to handle such data in the CAV ecosystem and we are developing policy in this area to ensure security, data protection and fair market access is maintained.

Recommendation 30: We recommend that the Government liaise with the ICO, automotive manufacturers and other interested parties, including international partners, to ensure that CAV and the data they produce comply with the relevant privacy and data protection legislation and that this legislation is appropriate and workable, and keeps pace with the technology.

Response: We agree with this recommendation and will continue to work closely with key stakeholders to develop appropriate policy on data governance for CAVs and the CAV ecosystem.

Recommendation 31: We welcome the Government's work at an international level to draw up standards for data retention in the event of an accident involving CAV. These standards will ensure that manufacturers provide access to the necessary data in the case of an accident. The Government must also ensure that the Police and the wider criminal justice system have the necessary skills, tools and access to be able to appropriately interrogate the stored data.

Response: It is likely that the global type approval regulations, implemented through European law and establishing standards for vehicles sold in the UK will require the use of data storage technology in vehicles that have advanced driver assist systems, and also in automated vehicles. The discussions for driver assistance systems are already underway.

The international debate on what data needs to be collected (beyond who, or what, was in control of the automated vehicle) still needs to take place. We need detailed engagement on who will need access to it, or how it should be shared to balance the needs of industry, the police and justice systems, and the privacy of vehicle users. As this work is taken forward, we will engage with the appropriate stakeholders to help deliver domestic and international solutions. We will give proper consideration to data access and forensics as part of this.

Recommendation 32: The increased development and deployment of CAV raises ethical issues. The Government should keep this in mind as it takes forward its programme of regulatory reform for CAV, including taking a leading role in the development of international standards to address the ethical issues. These standards will need to ensure that companies are transparent about the way vehicles deal with these issues.

Response: Connected and autonomous vehicle technologies offer significant social and economic benefits but there are a number of potential ethical, legal, and wider social issues linked with some uses. Government recognises that it has a role to play in managing and mitigating any risks that might arise and the importance of striking a balance within the regulatory framework to ensure that laws are in place to prevent harm to humans, while at the same time ensuring that innovation is not stifled and any barriers to the development of these technologies are removed where possible.

An important piece of work which will help inform this thinking is the wider Data Governance review provided jointly by the British Academy and Royal Society which investigates the full range of ethical and regulatory issues and how best the governance frameworks could be adapted to be fit for purpose in the contemporary digital age. We will engage with these bodies to ensure that proper consideration is given to these studies in developing government policy and regulatory positions.

Recommendation 33: We welcome the UK's leading role in the development of international regulation for marine autonomous vehicles and encourage the Government to continue to drive forward this initiative. There is potential for significant early benefit to accrue to the UK once a new international regulatory framework is in place

Response: The Maritime and Coastguard Agency (MCA) are leading early engagement with regards to maritime autonomy, infrastructure, competence and applications; recognising that autonomy in this environment is less mature than other modes.

This provides us with the opportunity for the UK to be a world leader within this field, and work has started to consider how emerging technologies within this space can offer the necessary equivalence with international maritime regulations.

Consequently, the UK is working closely with Industry to understand how the International Maritime Organization (IMO) regulatory framework will need to be amended to enable the safe, secure and environmental operation of Maritime Autonomous Surface Ships (MASS) within the existing instruments. At the most recent meeting of the Maritime Safety Committee of the IMO, our proposal to undertake a regulatory scoping exercise was approved, and the MCA is leading on this work.

It is anticipated that the results of this work will identify those regulations which would likely prohibit unmanned operations; are irrelevant to unmanned regulations; and which may affect the construction or operation of MASS. This will enable the IMO to plan appropriately for their introduction, as well as allow the UK to maintain its lead in this space and consider the onward challenges around conformity and infrastructure needs, as the technology develops.

DfT (through the MCA) and BEIS are working together to identify key interested parties and ensure that the UK are appropriately supporting innovation in Maritime autonomy, to enable the UK to become a natural home for the industry, drawing upon the strength of our supporting technologies (such as sensors) and the natural attraction of the UK as an island nation with an open regulatory framework which encourages development within the sector.

26 October 2017