24 October 2016

House of Lords Science and Technology Committee
Committee Office
House of Lords
London
SW1A 0PW

Dear Sir/Madam,

The IET’s response to the House of Lords Science and Technology Committee
inquiry on future uses of driverless vehicles in the UK

In response to your call for evidence, we would like to submit our comments to the inquiry questions on the above topic.

The Institution of Engineering and Technology is Europe's largest professional engineering and technology organisation. The members represent a wide range of expertise, from technical experts to business leaders, encompassing a wealth of professional experience and knowledge.

The IET is continuing to engage with key stakeholders on the technology and policy implications of adopting autonomous vehicles. The technology is progressing rapidly and our experts in industry and academia would be delighted to have an opportunity to discuss with you further the impact this will have on the transport system.

The below response is a short summary of the key issues on autonomy. Many of the points noted have been taken from the IET report on “Cross-modal Learning in Autonomy” that will be published in December 2016. If you wish to receive a copy of this report, or learn more about the project please do not hesitate to call.

If the IET can be of any further assistance please do contact us.

Yours faithfully,

Paul Davies
Head of Policy

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• What are the potential applications for autonomous vehicles?

1) The idea of highly automated or autonomous vehicles is not new, however, the landscape has been transformed over recent years with the application of advanced sensors, communication technologies and databases. Autonomous systems are already pervasive, particularly in aerospace with autopilot on planes and military drones.

2) The opportunities across the transport modes; road, railway, aerospace and maritime are immense and wide ranging but cross-cutting technologies are not often developed or even considered outside of each specific industry area leading to duplication of R&D, resourcing and implementation. One key opportunity here is to pool resources that can be transferable and provide technologies and innovations across all transport sectors for the benefit of all, including the end user.

3) The benefits of a move towards more autonomous vehicles are broadly similar in all sectors - ultimately promising significant safety enhancements, more efficient transport, greater flexibility of operation and, potentially, reductions in environmental footprint. However it is not yet clear how these systems will be introduced to deliver these expected benefits.

4) Taking autonomous cars as an example, congested cities might better optimise their road networks by eliminating the role of the driver, so they could control speeds and lane discipline and achieve steady flow. Recent demonstrations have shown that autonomous vehicles are technically feasible and we are starting to see them operate successfully on ‘live’ roads in ‘demonstration mode’.

5) As well as the major societal benefits, the introduction of autonomy is a multi-sector and multi-discipline opportunity for the UK manufacturing, infrastructure and services industry. The UK can build on the leverage of recent tests in autonomy to further enhance its position in research and development of autonomy where we are one of the leading nations at the moment.

• What are the potential user benefits and disadvantages from the deployment of autonomous vehicles?

6) Benefits – Road vehicles
- Driverless cars can carry out tasks and drives that would be too long, dangerous or expensive with a human driver;
- Congested cities might better optimise their road networks by eliminating the role of the driver; they could control speeds and lane discipline and achieve steady flow;
- DVLA figures record that nearly 4 million people holding a current driving licence are aged 70 or over. Autonomous Vehicles can bring holistic benefits to the health and well-being of our ageing population in remaining independent for longer where various automated function or full autonomous vehicles could
deliver real benefits. This also applies to impaired or disabled people for whom autonomous cars can bring greater freedom of mobility;
-  An autonomous vehicle can reduce fuel bills quite significantly. The human factor is removed from making the many decisions we are used to, making journeys smoother and increasing capacity. This also leads to better fuel efficiency and a reduction in emissions due to ‘steady-state’ driving and interaction with the traffic management infrastructure to minimise stop-start driving;
-  Reducing or removing the human factor can also improve safety.

7) Unmanned aircrafts are able to carry out tasks/ flights that would be too long, dangerous or expensive with a human pilot. These uses could include,
   - Infrastructure monitoring
   - Police and law enforcement
   - Environmental and agricultural monitoring
   - Disaster support
   - Military

8) There needs to be recognition that the technological and behavioural changes likely to result from a shift towards autonomous vehicles will initiate new and differing demands being placed on the public infrastructure. Consideration needs to be given now to how responses to these demands will be funded and how the current models of funding the provision of transport infrastructure need to change.

9) Autonomous vehicles will raise issues of safety, security (including cyber security) and resilience of networks in the future. Before large scale deployment of such technologies, there are many immediate issues in safety to be addressed.

10) There is a concern that trying to move straight to driverless trials may not foster public understanding and support. A roadmap from what we have now in terms of cooperative vehicles, through all the stages of automation to fully driverless vehicles needs to be established.

11) The development and use of automated and autonomous vehicles and issues related to these, including safety, insurance and land planning, are of great importance to the vehicle manufacturing industry as well as to infrastructure provision. It is recommended that this both technical and socio-economic trend is reviewed regularly by the government.

- Are further revisions needed to insurance, regulation and legislation in the UK to create an enabling environment for autonomous vehicles?

12) Regulators of different modes of autonomy need to work together to develop a common approach to autonomous regulation and software standards across all transport sectors. The UK should not do this in isolation from European and International partners.
13) The legal aspects of autonomy in road vehicles still requires further debate; the technology is enabling the car to make decisions and there needs to be a framework that clarifies the ownership of this decision making.

14) In addition to insurance and regulatory issues, there needs to be further work on the ethical decisions an autonomous system is programmed to make.

15) Currently the road vehicles that are being tested still require the driver to be fully engaged; “driver apathy” therefore needs to still be managed until driverless car technology reaches full autonomy.

- **What is the scale of the market opportunity for autonomous vehicles?**

16) Among experts there is generally high level of confidence that autonomous vehicles will become more pervasive. However, currently most road vehicles that are being tested have not reached a full level of autonomy. ‘Assisted’ rather than ‘autonomous driving’ might help the public get used to driverless vehicles on the roads.

17) The Government’s and the public’s appetite for risk will shape the regulatory framework required to permit the widespread introduction of autonomous vehicles, which in turn will impact the speed at which the technology becomes economically and commercially viable for individuals and organisations. User acceptance beyond the niche enthusiasts cannot be assumed (similar to electric vehicles – there are lessons that can be learned from their adoption).

18) Government should focus on explaining the benefits at the individual level and address the need for long term planning to introduce solutions onto the existing transport infrastructure, clearly safety will be uppermost in people’s minds and greater efforts to communicate the safety and mobility benefits would be a key focus.

- **Will successful deployment of autonomous vehicles require changes to digital or physical infrastructure?**

19) Current road vehicles fitted with automated systems make their decisions based on the speed and acceleration of other vehicles and through the use of sensors. However there are various methods of spatial and obstacle recognition being adopted by different manufacturers.

20) Connectivity will play a major role in the development of autonomous vehicles. In order to make better decisions, target vehicle behaviour will be broadcast using “Car to Car” and “Car to Infrastructure” communications and used to truly cooperate.

21) In level 2 autonomy, at least 2 functions within the car are automated, and the driver is disengaged from physically operating the vehicle however must still always be ready to take control of the vehicle. In order to progress beyond level automation 2 the industry requires further developments in 3 key areas:
   a. The ability to get much more information into the car and process it, so that it can be acted on appropriately. i.e. multi-sensor information being fused into
something meaningful, so that systems can be aware of the situation and project what other vehicles will be doing accurately.

b. The ability to re-engage the driver appropriately from automated level 3. i.e. The Human Factors in driver handover. This will include taking the appropriate course of action if a driver cannot be re-engaged.

c. The ability to navigate and resolve vehicle position accurately. i.e. The creation (or downloading of) high fidelity maps that are updated when changes (like road-works) are detected, so that they are useful to other vehicles AND matching what is sensed to that map to resolve position.

22) Much of the above cannot be investigated and resolved without the implementation of trails and demonstrations, where all the ‘what ifs?’ can be identified and addressed.