Written evidence submitted by Connected Places Catapult (SDV0035)

About Connected Places Catapult

Connected Places Catapult is the UK's innovation accelerator for cities, transport and place leadership. Our purpose is to connect people, places and businesses to a future of sustainable growth and prosperity.

We help businesses to grow by connecting the market, sparking innovative technologies, and accelerating commercialisation. We strive to create functioning markets where people, places and businesses are connected to the resources, ideas, and relationships they need for all to prosper.

In 2019 the Transport Systems Catapult and Future Cities Catapult merged to create the Connected Places Catapult. Connected Places Catapult is part of the Catapult Network, established by the UK Government's innovation agency, Innovate UK.

Introduction

The Connected Places Catapult welcomes the Committee's interest in the development and deployment of Connected and Autonomous Vehicles (CAVs). The uses and benefits of CAVs have been reported extensively, and their potential to deliver social and environmental benefits with the right policy interventions is significant. Bringing this technology to market and delivering these benefits involve complex barriers, and these can only be overcome with further intervention from the Government.

Despite these benefits and the successful demonstrations discussed below, we have not seen CAVs rolled out as widely as perhaps once expected. There is enormous opportunity in CAV technology – the market for CAVs in the UK is forecast to be worth £41.7bn in 2035[1] – and there is great drive and capability within the UK to lead the way. We welcome the opportunity to discuss the possibilities that CAVs offer, as well as the barriers to overcome and policy interventions required to support the development of CAV capabilities.

The likely uses of CAV, including private cars, public transport and commercial vehicles

The longer-term opportunities in private cars may make the headlines but CAV technology is now ripe for use in controlled areas and is already seeing

utilisation in the logistics market with organisations such as Amazon and Ocado. While access is limited to large enterprises, due to the scope of research and development required, investing in the development of common practices would increase the market base, accelerate the development of capabilities, and grow the CAV ecosystem by drawing on experience from this sector. With sufficient investment, we could see this technology more widely applied in areas such as passenger and freight transportation.

Using CAV within controlled environments, such as factories, or in confined but complete journey situations such as passenger and freight transport, will limit the benefits. However, this will provide opportunities to further prove the technologies and grow the CAV ecosystem in the medium term therefore enabling longer term opportunities with broader markets and impacts to be realised.

Using CAVs is not only beneficial for freeing up consumer's time and capacity. Active development in mobility-as-a-service products (such as Wayve) and supporting software and tooling (such as Oxbotica and Five) represents a levelling-up opportunity. CAVs have the capability to make transport accessible to those that may otherwise be excluded, either due to physical accessibility considerations or due to geographical location. Connected Places Catapult were part of the Flourish consortium[2] which explored how CAV technology can be harnessed to enhance and enable mobility for older adults and those with mobility-related needs.

Progress of research and trials in the UK and abroad

An early report by the Transport Systems Catapult[3], found that CAVs have the potential to reduce air pollutants, congestion, and the number and severity of road collisions, while improving the 'value of time' for consumers and access to mobility to those without access to privately owned vehicles. The report also speculated that there could be impacts on public finances, such as affecting revenues generated through driving licenses, vehicle registrations, fuel taxes and fines.

The near-term potential of autonomous road transport was explored in a 2020 report, The Drive for Automation[4], by The Connected Places Catapult. This report also gives a brief overview of research and development projects successfully executing CAV demonstrations. The LUTZ Pathfinder project delivered the world's first autonomous vehicle demonstrator in a public space,

HumanDrive delivered the single longest journey by an autonomous vehicle on UK roads at over 200 miles, and Auto Valet Parking (AVP) concluded in a successful demonstration.

Potential implications for infrastructure, both physical and digital

It is increasingly likely that digital infrastructure will play a key role in the deployment of CAV based services, including concepts such as connected intelligence. These can provide a means by which remote operators can oversee CAV operations on a one-to-many basis. Additionally, the provision of data can enhance CAV situational awareness to improve CAV operations such as path planning and CAV trajectories. For example, the digital signalising of junctions will play an important role in the smooth operation and deployment of CAV services. It will be essential to make such data available to CAVs by enshrining it in policy to realise the full benefits of this.

Regulation and authorisation

We have already seen CAV technology being applied in vehicles on the road today, through programmes such as 'driving assist', which allows the technology to take over from a human driver to perform specific driving tasks. Major automotive manufacturers have already rolled this out for particular use cases. This has proven to have a large market potential, with functions such as parking assist. However, the time to market varies based on the challenges related to each driving function.

The foundations have been laid to see assisted driving in motorway conditions with the approval of regulations for Automated Lane Keeping System (ALKS) and traffic jam assist. However, to see this rolled out requires us to overcome further assurance challenges.

A potential framework to address some of these pre-market safety assurance challenges is presented in the CertiCAV Assurance Paper[5] completed by the CPC in co-operation with Warwick Manufacturing Group on behalf of the International Vehicle Standards division of the UK Department for Transport. From this work, we concluded:

- that to enable autonomous vehicles to market, stakeholders must build productive relationships and common understanding with each other

- the availability of CAV governance, assurance and standards provide certainty to market that enables ongoing investment and growth, and this should be a key target for Government
- a key win for the industry and the UK will be to develop the knowledge and skills to allow the market to overcome the future challenges and deliver the opportunities.

Safety and perceptions of safety

In considering the replacement of the human driver by a system of sensors and automated decision making, users and the public need to be confident that the Automated Driving System (ADS) can operate effectively at a whole system level across the full range of situations it is likely to encounter. Creating confidence and developing trust in CAVs is a key barrier to bringing this technology to the wider market.

As part of this process, the capabilities of the technology need to match what it is being asked to do. In the near-term, operating in controlled or very specific environments present the best opportunity for building public confidence in the technology. This provides an opportunity for the technology, governance and public trust to develop and support more complex activities that ultimately deliver the impact expected from CAVs.

For wider rollout, it is not realistic to test every combination of sensor input and driving situation due to the time and cost required to do so. However, simulation, modelling and testing has the potential to fill this gap and to enable rigorous, controlled and timely evaluation of ADS systems. VeriCAV[6] has harnessed the technology of digital twins, advanced simulation and improved modelling techniques to speed up and reduce the cost of CAV deployment. Developed by Connected Places Catapult and partners and funded by the Centre for Connected and Autonomous Vehicles (CCAV) via Innovate UK, this method can validate and verify CAVs by recreating countless scenarios of varying complexity.

The Role of Government

For CAVs to function safely in a real-world environment, there also needs to be a meaningful integration with transport in a UK context, as discussed above. The rules of the road (i.e. The Highway Code) is not written in a formal language which can easily be translated to software. Work is required to formalise the rules to support further development and testing. A system of

top-level requirements and formalised ethics need to be defined to establish the foundation of a trustworthy system for deployment. Our work has concluded this needs to be more formal than 'careful and competent' and more finessed than 'positive risk balance'

Local authorities will be key in ensuring CAVs provide a positive societal impact. They will be involved both from a local transport perspective but also due to the responsibility they have for their road infrastructure. Local authorities such as Oxfordshire, Greenwich, Milton Keynes, Coventry have been proactively involved in CAV research. These UK learnings should be built upon so local authorities are sufficiently prepared for the introduction of CAVs.

There is speculation that CAV technology will contribute to the decarbonisation of transport by enhancing efficiency. CAVs have significant potential here, but it is not guaranteed – even with the assumption that all CAVs are fully electric. A recent report by Connected Places Catapult[7] has found that certain CAV usage scenarios could result in an overall negative consequence if interventions are not made. This report makes several suggestions for policy interventions to help mitigate this risk, such as discouraging 'empty miles' while encouraging interoperability with public transport and optimising use of land and infrastructure.

Conclusion

Connected and Autonomous Vehicles have the potential for huge benefits and opportunities to the UK. The knowledge developed builds the capability for other technologies and automation use cases, for example Connected Places Catapult is utilising our learning in developing drones and automation in maritime for the wider benefit of the UK economy. There is still work to do but in the benefits for accessibility and the opportunities for people who could not travel easily before will be transformational.

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Endnotes

[1] Connected Places Catapult market forecast for connected and autonomous vehicles (publishing.service.gov.uk)
[2] http://www.flourishmobility.com/

[3] ATS40-Future-Proofing-Infrastructure-for-CAVs-Report.pdf (netdna-ssl.com)
[4] The Drive for Automation Mobility Report - Connected Places Catapult
[5] https://cp.catapult.org.uk/report/assuring-the-safety-of-connected-and-autonomous-vehicles/
[6] Home - VeriCAV (vericav-project.co.uk)
[7] https://cp.catapult.org.uk/wp-content/uploads/2021/04/The-CAV-Decarbonisation-Paradox-Nov-2020-Final.pdf