

CASE STUDY

WHO WE ARE

The Connected Places Catapult (CPC) is an independent, trusted, expert broker operating at the intersection between the public and private sectors and between local, regional and national decision making. We promote UK innovation and broker relationships between government, academia and industry providing support and solutions for innovators to commercialise their projects and research. With our deep expertise in technology, we bridge the gap between buyers, suppliers, innovators and industry. Our agile approach enables us to convene our partners to act rapidly to create new market collaborations responding to public funders and industry needs. We boost demand for innovation to unlock wider economic and environmental benefits.



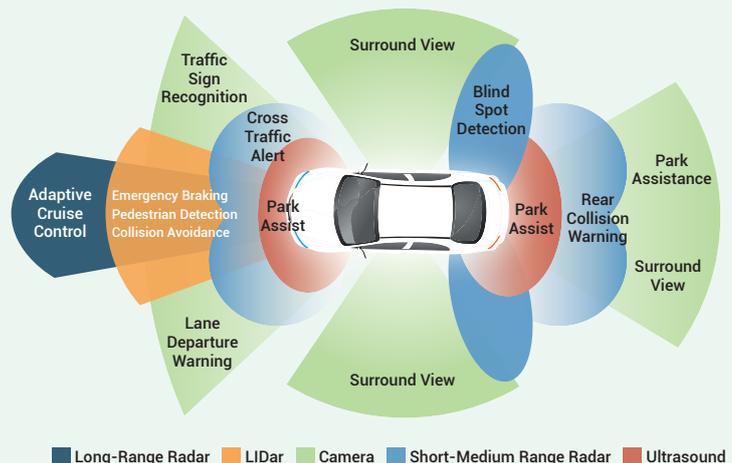
Connected and Autonomous Vehicles Sensor Testing

Working with innovators to understand the challenges and create solutions for a world leading CAV sensor testing programme in the UK

Challenge

The automotive sector is on the cusp of a revolution. The development of increasingly connected and autonomous vehicles (CAVs) brings the potential for truly transformative change in the way people and goods are transported, offering significant improvements in safety, efficiency, mobility, productivity and user experience.

CAVs must overcome challenges to safety, cost, reliability and acceptability in society. CAVS and vehicles with advanced driver assistance systems rely upon sensors to determine their physical environment and the behaviours of other road users around them. Taking the place of the human driver's eyes, ears and other senses, these sensors have attributes that make them capable of certain types of automated driving tasks as shown below:



However, it is vital to understand how sensors may fail to respond correctly, in different weather conditions and environments for example. For instance, snow might stick to a radar and block it, Direct sunlight could blind a camera, or heavy rain can significantly reduce its detection range. As the deployment of such sensors accelerates, it is critical for the automotive industry to understand and characterise these affects so that mitigations can be designed into the systems to ensure safe and reliable automated driving.

Significant barriers to this technology deployment exist.

- ◆ The specialised facilities essential for design, evaluation and validation of sensors in particular are currently lacking in the UK.
- ◆ The development of the testing sector needs to continue otherwise there is a risk that UK testing capabilities will fall behind international competitors, leading to manufacturers and their suppliers taking their business elsewhere.
- ◆ The UK needs a robust testing sector to support the UK automotive industry.

For the Centre for Connected and Autonomous Vehicles (CCAV) a vital step is understanding the issues to be solved, enabling a co-ordinated investment and development strategy to be deployed.

Solution

In 2018 CCAV commissioned CPC and National Physical Laboratory (NPL) to undertake a feasibility study to investigate these key issues including the requirements, infrastructure and facilities needed to enable reliable CAV sensor testing and validation. The project started in June 2019.

This marked a first for the CPC and NPL working collaboratively. The two organisations worked closely with the Meteorological Office – Met Office – the United Kingdom's national weather service. The collaboration enabled a robust approach to addressing new methodologies, standards, performance criteria and physical facilities. The ultimate objective is to help UK businesses, including development and testing infrastructure, have access to solutions which enhance their global competitiveness.

A key requirement was understanding the steps needed to characterise the performance of a typical sensor system under a wide range of environmental conditions. Identifying how to develop and validate robust sensor models for virtual simulation testing, for example, was one consideration.

Stakeholder engagement

CPC and NPL engaged with key experts and innovators to contribute to the study. Some 20 cross-sector organisations actively participated via a series of face-to-face or telephone interviews and questionnaires supported by desk research plus business and scientific analysis. They included: Government bodies, regulators, standards bodies, industry, trade associations and universities.

Outcomes

The study resulted in a roadmap and series of recommendations to develop next generation facilities for testing the influence of weather and environmental factors on sensors for autonomous vehicles. Key findings include:

- ◆ Existing test facilities and services have not necessarily been designed for the explicit needs of autonomous vehicles sensing capabilities.
- ◆ The testing of sensors is an important part of the wider CAV Validation and Verification programme but must not be considered in isolation from the other parts.
- ◆ The recommended approach builds on the 2017 Innovate UK and CAV test bed programme of £55 million research funding to create the world's most effective CAV testing ecosystem by creating a number of distinct test capabilities.

CPC creates value

There is an opportunity to build on the collaboration between CPC and NPL enabling a robust approach to addressing new methodologies.

- ◆ The main impact from this collaborative project is the potential creation of CAV sensor testing facilities for the UK, funded through CR&D competitions run by CCAV. This would help the UK to maintain its position as a leading country in the development of CAVs.
- ◆ The creation of a CAV sensor facility will enable companies based in the UK to access the required facilities to further develop and test their products.

Benefits

- ◆ CPC has previously contributed to the content of the **Code of Practice: Automated vehicle trialling** [\[Link\]](#) published by CCAV ensuring that the UK has a highly reputable automotive testing expertise with significant investment in Test bed UK and the ability to test CAV anywhere in the UK.
- ◆ The UK has invested heavily in the CAV test bed programme with the Innovate UK and CAV 2017 test bed competition offering industry and academia £55 million research funding to create the world's most effective CAV testing ecosystem by creating a number of distinct test capabilities.

This CPC feasibility study proposes a programme to be established to develop and validate a standardised, reliable and usable CAV sensor testing technical framework.

Next steps

This feasibility study recommends:

- ◆ A short time frame project is undertaken as a proof of concept for a usable and reliable framework for characterising sensor performance in different weather-related conditions.
- ◆ Establishment of a programme to deliver a usable and reliable framework for characterising sensor performance in different weather-related conditions, including the ability to assess performance outside the design envelope. (Dependent on recommendation 2).
- ◆ Development of technologies which can repeatably recreate the weather conditions encountered by CAV sensors.
- ◆ Creation of a UK Government/industry co-funded environmental testing infrastructure, to support both development and performance characterisation of single sensors and the testing and validation of sensor suites and whole vehicle systems.

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