C-ITS and Automated Vehicles: Challenges and opportunities

Professor Phil Blythe
Chief Scientific Advisor

IET International Conference on
Intelligent and Connected Vehicles (ICV 2016)
The CSA: My Objectives

- Provide leadership on developing technology and innovation
- Improve the strategy for science and innovation research to maximise value across policy areas
- Maximise value from stakeholder research, in particular in EU and Universities
- Position DfT as a leader in science across Whitehall and maximise value of the SAC
- Develop stronger links between science and internal stakeholders and provide strategic science input into analysis work programmes
- Identify and deliver on a number of high priority scientific issues including:
  - air quality and vehicle emissions;
  - intelligent infrastructure;
  - older people mobility;
  - big data/smart Cities;
  - railway signalling;
  - engineering skills; and
  - cooperative and autonomous vehicle
Autonomous Vehicles

- Centre for Connected and Autonomous Vehicles (C-CAV) works to promote them by:
  - leading innovating policy development in this sector
  - delivering a programme of research, development, demonstration, and deployment activity, worth up to £200 million
  - providing co-ordination across government departments
  - being the single contact point for stakeholder engagement
Government’s approach to Connected and Autonomous Vehicles
The advent of Connected and Autonomous Vehicle technologies heralds a revolution in the way we experience and think about mobility.
QUEEN'S SPEECH

GOVERNMENT TO "CREATE RIGHT FOR EVERY UK HOUSEHOLD TO ACCESS HIGH-SPEED BROADBAN"
Government recognises the potential

- safety
- mobility
- efficiency
- productivity
<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DRIVER ONLY</th>
<th>DRIVER ASSIST</th>
<th>ADVANCED DRIVER ASSIST</th>
<th>HIGHLY AUTOMATED</th>
<th>FULLY AUTOMATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>DRIVER ONLY</td>
<td>DRIVER ASSIST</td>
<td>ADVANCED DRIVER ASSIST</td>
<td>HIGHLY AUTOMATED</td>
<td>FULLY AUTOMATED</td>
</tr>
<tr>
<td></td>
<td>EYES ON</td>
<td>HANDS ON</td>
<td>HANDS OFF (TEMPORARY)</td>
<td>EYES OFF</td>
<td></td>
</tr>
</tbody>
</table>

**EYES OFF**

**EYES ON**

**HANDS ON**

**HANDS OFF**

**HANDS OFF (TEMPORARY)**

- **Driver is responsible for the vehicle.** Controls lateral and longitudinal movement at all times.
- **System can support lateral OR longitudinal control.**

**LEVEL 1**

- **Driver is responsible for the vehicle.** Controls lateral and longitudinal movement at all times.
- **System can control lateral OR longitudinal movement in specific use cases.**

**LEVEL 2**

- **Driver is responsible for the vehicle.** Controls lateral and longitudinal movement. May hand some control over to the system.
- **System can control lateral OR longitudinal movement in specific use cases.**

**LEVEL 3**

- **Driver is responsible for the vehicle.** Controls lateral and longitudinal movement. Can hand full control to the system.
- **Where system exceeds performance limits, it will hand control back to the driver.**

**LEVEL 4**

- **Driver is only responsible, and exercises control when the system is not in use.**
- **System can control lateral AND longitudinal movement in all use cases.**
- **System can control lateral AND longitudinal movement in specific use case.**
- **It will not require driver intervention during this time.**

**LEVEL 5**

- **Fully Automated.**
- **Driver intervention is not needed.**

**Driver control**

**System control**
There are social benefits...

- Driving will be safer and easier; emissions and congestion reduced
  - 1700+ people are killed on the UK’s roads every year (and 1.25 million globally) – and our roads are some of the safest in the world.
  - By 2030, these technologies could prevent as many as 2,500 deaths.

- The UK’s ageing population is seeing more people have to give up their driver’s licence;

- Fewer young people are taking a driver’s licence or owning a vehicle.

- These technologies will offer mobility for vulnerable sectors of society, unable or unwilling to take the wheel, and enhance quality of life.

A welcoming regulatory environment
Connected and Autonomous Vehicles
We need real world demonstration

We want the UK to be at forefront of research, development and demonstration of connected and autonomous vehicles (CAVs).

Four cities driverless car trials

- Government is investing, with industry match funding, in 3 major real-world trials of autonomous vehicles around the country.

**GATEway** – Three types of CAVs in Greenwich including passenger shuttles, and freight delivery.

**Venturer** – CAV equipped BAE Wildcats and lightweight self driving pods in Bristol.

**UK Autodrive** – A fleet of 40 autonomous pods, along with road cars, will be trialled in Milton Keynes and Coventry.

**Truck Platooning**

- Following from 2014 feasibility study, trial will focus on operational impacts and benefits.
  - What are potential benefits to fleet operators?
  - How do platoons respond to UK network designs?
£100 million Intelligent Mobility Fund
Match-funded by Industry up to £200 million (2015-2020) this competition fund will support collaborative R&D in these technologies.

The first, £20 million round (CAV1) launched in February 2016 and includes eight CR&D projects and 13 feasibility studies.

The second round (CAV2) opened on 22 August 2016 for up to £35 million in four streams to provide real-world user and commercial benefits, including as part of a wider transport system.

1. A large-scale challenge to develop and demonstrate a vehicle operating at SAE level 4 automation.

2. – 4. Feasibility studies and industrial R&D projects.
Centre for Connected & Autonomous Vehicles

SHEFFIELD/NOTTINGHAM
HAMILTON/LIVERPOOL
BIRMINGHAM
OXFORD
BRISTOL

NEWCASTLE
MILTON KEYNES/CRANFIELD
GREENWICH:
LONDON-DOVER

Demonstration
Public Perception and understanding social and behavioural issues vital to AV adoption

What journeys will people want to use an AV for?

What are people’s fears about AVs? How can we best overcome these?

How will the market for AVs develop?

What types of people will be most attracted to AVs?

• Identify and prioritise key questions

• provide recommendations for what research will be needed over the next two years

By October 2016: a road map of the key social and behavioural questions
“Talking Signals”
Connection into vehicle or device
Compass 4D: Use Cases

- Road Hazard Warning (RHW)
- Red Light Violation Warning (RLVW)
- Energy Efficient Intersection Service (IEIS)
Compass 4D: Newcastle Pilot
Centre for Connected & Autonomous Vehicles
Link travel times

Link travel time by time of day

<table>
<thead>
<tr>
<th>Time of day</th>
<th>Travel time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>230</td>
</tr>
<tr>
<td>MD</td>
<td>180</td>
</tr>
<tr>
<td>AM</td>
<td>230</td>
</tr>
<tr>
<td>SB</td>
<td>180</td>
</tr>
<tr>
<td>MD</td>
<td>180</td>
</tr>
</tbody>
</table>

- Control
- Experimental
Electric vehicle power consumption

Average power consumption per run

Centre for Connected & Autonomous Vehicles

Power consumption (kWh)

<table>
<thead>
<tr>
<th>AM</th>
<th>MD</th>
<th>AM</th>
<th>SB</th>
<th>MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>700</td>
<td>300</td>
<td>200</td>
<td>150</td>
</tr>
</tbody>
</table>

Control
Experimental
‘A2 / M2 London to Dover Connected Corridor’
The UK for automotive investment

Since 2008, the UK has emerged as a leading location for automotive investment, based on three key factors:

- Growing supply chain opportunity
  - Strong domestic and export market
  - Huge supply chain opportunity
  - Increased local sourcing from OEMs

- Transformational research & development
  - Global centre of R&D capability & motorsport
  - Leading automotive R&D facilities
  - World leader in low carbon technologies

- Supportive business environment
  - Funding & support at national, regional and local level
  - Strong relationship between government and industry
  - Competitive incentives for businesses
Three UK core capabilities

Low carbon propulsion
- £1bn investment in Advanced Propulsion Centre (APC)
- UK is now European leader in EVs for both:
  - Production (25% of EU total)
  - Sales (20% of EU total)

Light weighting
- JLR most intensive aluminium car manufacturer in world
- National Composites Centre – focus of UK R&D
- £40m invested in 2015, and more to follow
- UK supply chain for composites is developing rapidly

Connected and autonomous vehicles
- Centre for Connected and Autonomous vehicles (CCAV)
- £200m in matched funding for CAV R&D
- UK has most progressive regulatory environment