

UK Connected and Autonomous Vehicle Research and Development Projects 2017



Centre for Connected
& Autonomous Vehicles

 @CCAV

 enquiries@ccav.gov.uk

 gov.uk/government/organisation/centre-for-connected-and-autonomous-vehicles



Centre for Connected & Autonomous Vehicles

The Centre for Connected and Autonomous Vehicles (CCAV) is a joint unit of the Department for Transport and the Department for Business, Energy and Industrial Strategy (formerly the Department of Business, Innovation and Skills) set up to keep the UK at the forefront of the development of connected and autonomous vehicle technology. It is a single point of contact for those in industry, academia and internationally, and aims to ensure:

- The UK has a vibrant, world-leading connected and autonomous vehicles industry
- The UK remains one of the best places in the world to develop and use connected and autonomous vehicles
- Research on connected and autonomous vehicles is effective, and targeted at delivering value for the UK

Connected and autonomous vehicles are safe and secure by design, and handle data appropriately. For further information and to stay updated on the latest news and government activity on connected and autonomous vehicles visit www.gov.uk and follow us on twitter at @ccavgovuk.

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Four Cities Trials – Driverless Cars

Instigated in 2014, before the creation of the Centre for Connected and Automated Vehicles, this was the first competition to be focussed on research and development of a future autonomous transport system.

The Scope section for the competition said:

“This competition is focused on delivering robust town/city-based consortia that are capable of proving how driverless vehicles will be integrated in a real-world environment.

Successful projects will demonstrate close collaboration with partners such as technology developers, supply chain companies and manufacturers.

Each trial must enable both the demonstration of passenger cars (M1 vehicles under the EU classification) that can operate part of the time on roads without driver control and at least one other form of ground-based urban transportation (excluding light rail, heavy rail and guided rail systems) that can operate part of the time without driver control.”





GATEway is collaborative research project led by TRL and funded by Innovate UK with support from commercial partners and overseen by the Centre for Connected and Autonomous Vehicles (CCAV). The study will test a range of different automated vehicles in the Royal Borough of Greenwich and investigate how the public and industry learn to trust and accept automated vehicles as part of the urban mobility landscape.



Objectives:

Test a range of automated vehicles in a real world urban environment.
Engage a range of participants to assess their trust and acceptance of automated vehicles

Milestones:

- May 2016 – Project commenced
- Sept 2016 – data gathering
- Dec 2016 – data modelling
- Mar 2017 – requirement assessment
- May 2017 – final project outputs

Challenges:

- Development of workable automated vehicle platforms.
- Working with a range of stakeholders to deliver automated vehicle trials.



Project successes:

- Collaboration, knowledge sharing and thought leadership with industry partners
- Developing an extended ecosystem of partners, specialists, OEM's and others who will help develop and deliver the future of connected and autonomous vehicles

TRL project lead: Simon Tong stong@trl.co.uk

Consortium members:



UK Autodrive

Milton Keynes leading the way in partnership with Coventry and the motor industry

Project synopsis:

UK Autodrive will trial and demonstrate Connected and Autonomous Vehicle technology in the urban environment. It will enable us to demonstrate the interoperability of different approaches and technologies, as well as broader issues such as public attitudes, commercial viability, environmental benefits, and how these technologies might be further developed and scaled to suit the needs of particular cities.

There are two key technical elements to the project – the trial of CAV technologies in passenger cars (Ford, Jaguar Land Rover and Tata Motors European Technical Centre), both on track and on roads in Coventry and Milton Keynes, and the trial of an on-demand, point-to-point public transport system of 40 driverless pods in Milton Keynes.

Objective:

To publically demonstrate connected and autonomous passenger car technology, together with a new 'pod' based autonomous transport system in city environments. To determine what cities need to do in order to promote the use of connected and autonomous vehicles, whilst understanding what benefits the new technologies could bring to the urban environment.

Key milestones:

Autumn 2016

- first track-based connected and autonomous car demonstrations
- development and production, and first testing of pods

Spring/Summer 2017

- second track-based connected and autonomous car demonstrations
- start of in-theatre pod testing in Milton Keynes

Autumn 2017

- first connected and autonomous car demonstrations in Coventry and Milton Keynes

Spring/Summer 2018

- Second connected and autonomous car demonstrations in Coventry and Milton Keynes
- Full public pod (low-speed autonomous transport system) trial in Milton Keynes

Challenges:

- Programme co-ordination
- Pace of technological change

Project successes:

Project lead:

Tim Armitage (Arup)

VENTURER



VENTURER is a £5 million research and development project funded by the government and industry and delivered by the UK's innovation agency, Innovate UK. VENTURER focuses on the users as well as the technology side in order to understand the blockers and drivers to wide scale Connected and Autonomous Vehicles (CAV) adoption. This is being achieved through assessing the responses of passengers and other road users to driverless cars in a series of increasingly complex trial scenarios in simulation and on real roads in Bristol and South Gloucestershire.



Objectives

- Develop an understanding of the public acceptance, legal and insurance blockers to Connected and Autonomous Vehicles.
- Development of a proven independent test site for Autonomous Vehicles (AV).
- Test cases developed by social, legal and insurance experts and evaluated using real roads and a fully immersive simulator.

Challenges

- Testing vehicles on real roads and in simulation to understand a range of scenarios.
- Understanding public perception and acceptance of CAV.
- Developing appropriate legal and insurance regulation and policy.
- Reviewing the technology's capabilities.
- Creating a fully immersive simulator as well as physical testing environments.

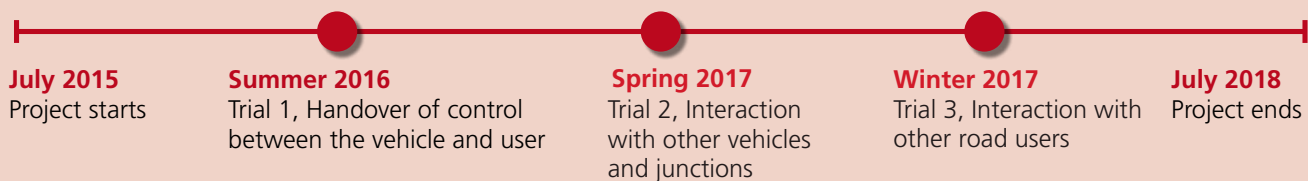
Project successes

- Developing the region as a world class testing facility for CAVs.
- Deep understanding of public perceptions and acceptance of CAVs.

Contact

Carolyn.Mitchell@atkinglobal.com
Or @Venturer-cars
Or visit: www.venturer-cars.com

Project milestones



Connected and Autonomous Vehicles 1

Building on the government's 'Introducing driverless cars to UK roads' collaborative research initiative, this competition aimed to encourage development of connected and autonomous vehicles, focusing on three themes – connectivity, autonomy and customer interaction – along with catalysing new business models.

The Competition Scope sought proposals that fell into one or more of the following thematic areas for both collaborative R&D and feasibility studies:

- connectivity
- autonomy
- customer interaction



FLOURISH is a multi-sector collaboration, helping to advance the successful implementation of Connected and Autonomous Vehicles (CAVs) in the UK, by developing services and capabilities that link user needs and system requirements. The three year project, worth £5.5 million, seeks to develop products and services that maximise the benefits of CAVs for users and transport authorities. FLOURISH is funded from the government's £100m Intelligent Mobility fund administered by the Centre for Connected and Autonomous Vehicles and delivered by the UK's innovation agency, Innovate UK.

Objectives

- Develop an understanding and articulation of user needs and expectations of CAVs.
- Develop usable adaptive interfaces, performance certification processes, products and services that enable secure, trustworthy and private technology within CAVs.
- Capitalise on the data created by CAVs to develop innovative new tools and products.
- Leverage existing investment in the Bristol and South Gloucestershire region to expand validation and test capabilities in both urban and inter urban networked environments.

Challenges

- Developing a deep understanding of consumer demands and expectations, including the implications and challenges of an ageing society.
- FLOURISH will address vulnerabilities in the technology powering CAVs, with a focus on the critical areas of cyber security and wireless communications.

Project successes

- Collaboration and knowledge sharing.
- Development of market leading CAV products and services in two main areas:
 - Connectivity including security and data management and analysis; and
 - Customer interaction.

Project milestones

- **Summer 2016** - Project Start
- **Summer 2017** – Simulator Trial 1
- **Winter 2017** – Car Based Trial 1
- **Winter 2017** – Simulator Trial 2
- **Spring 2018** – Pod Based Trial 1
- **Summer 2018** – Car Based Trial 2
- **Autumn 2018** – Simulator Trial 3
- **Winter 2018** – Car Based Trial 3
- **Spring 2019** – Pod Based Trial 2
- **Summer 2019** - Project End

Partners



Supporting Partners



Contact: tracey.poole@atkinsglobal.com Or visit: www.flourishmobility.com

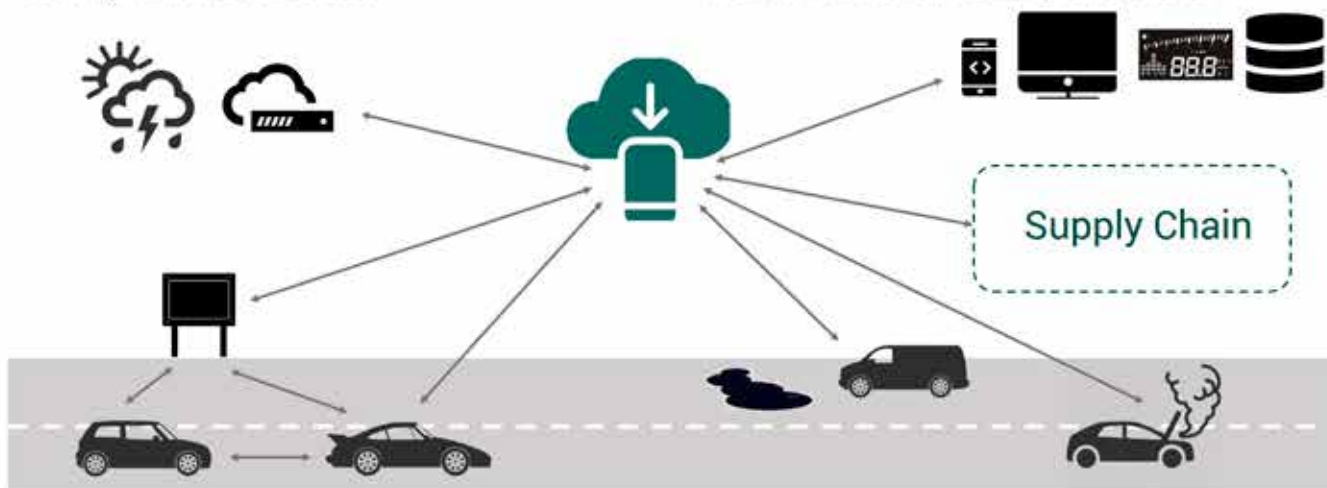
i-Motors

Predictive Contextual Intelligence in Connected and Autonomous Vehicles



i-Motors is working towards viable, commercially sustainable Smart Mobility applications for connected and autonomous vehicles.

- Reduce carbon emissions
- Monitor traffic in real time
- Identify infrastructure issues
- Reduce traffic accidents and injuries
- Reliable and accurate journey information
- Monitor vehicle health and predict issues



Objective:

The aim of this project is to carry out the R&D required to create an innovative method of providing a cooperative intelligent traffic system through:

- Communication between vehicles
- Processing of information from various sources
- Delivery of secure and trustworthy information to drivers using a timely and safe method
- Delivery of improved traffic management information to drivers and other stakeholders
- Delivery of security and safety information to the automotive sector

Challenges:

Scalability and latency, Connectivity issues, Cost versus connectivity

Successes:

Resilient, highly scalable VCC platform architecture
Several high quality stakeholders on board
Encouraging research on driver trust and acceptance

Milestones:

Identification of the needs of a range of stakeholders
Terrestrial M2M extension / Space Based M2M Adaptation
Analyses on the driving task results
Report on M2M platforms and EU recommendations for V2X communications
Integration and test plans
Minimum required industry standards for positioning, navigation and connectivity
GNSS highly accurate IRU Integration
Scalable platform to store vehicle data
Dynamic predictive and on the fly maps / contextual intelligence
Demonstrate near real-time feedback from the system
Identification and prioritisation of different factors influencing user's trust
Telematics dashboard complete
GNSS corrections using GSM/GPRS and satellite communications / sensor integration systems and algorithms
M2M platform prototype, PoC Demonstrator
Project final report & dissemination

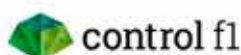
Update:

Dynamic Task Scheduler system - anticipates congestion, weather and other factors to provide a contextually intelligent schedule (useful for service based industries, logistics / delivery, fleet managers etc)
Patent and demonstrator for driver identification based on driving style
Patent and demonstrator for data throttling/prioritisation based on contextual intelligence
Developed a scalable location hardware platform with a configurable GNSS NRTK software tool
Exploring the use of natural language HMI solutions to improve user trust and acceptance of automated vehicles
Focussed on commercialisation and are developing - business and service models; service transition process

Project Lead Contact Information:

Dale Reed, Control F1 Ltd, www.controlf1.co.uk, dale.reed@controlf1.co.uk, www.i-motors.cloud

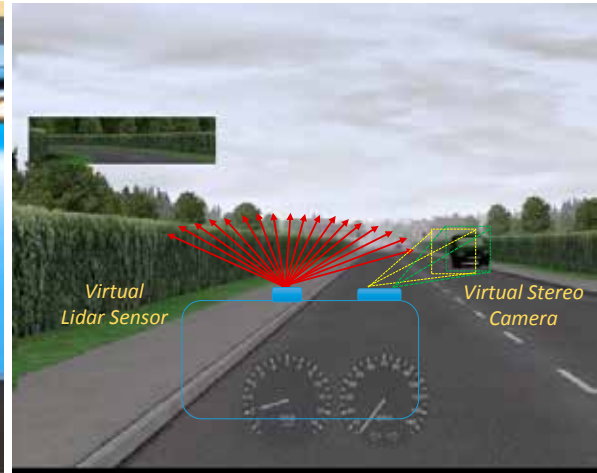
Consortia:



(INTACT)

INnovative Testing of Autonomous Control Techniques

Project number 102587

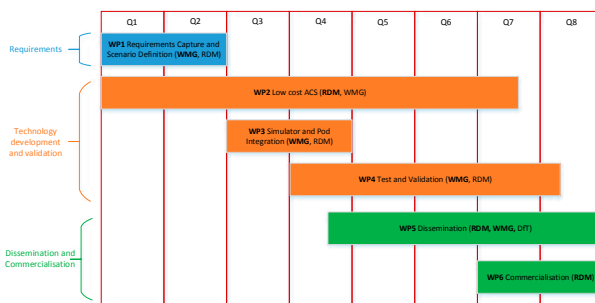


OBJECTIVES

- INTACT will facilitate collaboration between RDM and Warwick University researchers, to develop a novel simulator concept, to enable the design, test and evaluation of Autonomous Control Systems (ACS). This will enable the broader uptake of autonomous Pods
- The ‘vehicle in the loop’ simulation capability will enable the definition of a test specification and demonstration of a new set of test procedures for Autonomous Vehicles in a safe, repeatable, controlled and scientifically rigorous environment feeding in to future standards.
- A proposed test standard will be validated during the development of a reduced cost and optimised ACS implemented in RDM’s autonomous Pod.
- INTACT will complement UK Autodrive as it will be delivered within a 24 month period

ACHIEVEMENTS

- First Pod with RDM ACS recently demonstrated to Transport Secretary at MK50 event
- Proposed standard outline agreed with ISO TC 204 WG14
- Pod integrated into WMG simulator environment at Warwick University



CURRENT WORK

- Research of passenger interactions, public interactions, perception and acceptance
- Publication of technical papers to provide evidence for future policy frameworks
- ACS refinement and validation

INTACT is jointly funded by government and industry. The government’s £100m Intelligent Mobility fund is administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK’s innovation agency, Innovate UK.



INSIGHT upgrades an existing electric autonomous Pod design with advanced sensors to detect & recognise pedestrians, cyclists, mobility scooters, and other road users; and control systems for safe, low speed operation on pedestrian areas. Wireless connectivity manages the vehicle fleet & enables novel applications. Innovative interfaces provide visually impaired users with a much improved journey experience. www.insightcav.com



INSIGHT Objectives:

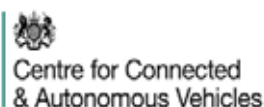
1. Develop connected & autonomous PODs including sensors & control systems
2. Trial in city centre pedestrian areas
3. Evaluate use by mobility impaired people
4. Develop & test vehicle & service interfaces for vision impaired people
5. Demonstrate 2 novel applications for data from low speed urban shuttles

INSIGHT Selected key milestones:

- Oct 16 – Specify management system
- Dec 16 – Advisory group 1st meeting
- July 17 – Safety case complete
- Sep 17 – Commission pod operation
- Mar 18 – Private pod track testing
- Oct 18 – Private pod trials
- Feb 19 – Public city centre pod trials
- Jun 19 – Final report & showcase



Project lead: Julian Turner CEO Westfield julian.turner@westfield-sportscars.co.uk



INSIGHT is a £2.2M CAV1 Collaborative R&D project with funding from industry and academic partners and from the government's £100m Intelligent Mobility Fund administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK.



Helping to establish the UK as a world leader in the development and testing of autonomous vehicles

Objectives

The overall objective of the project is to accelerate the development, market readiness and deployment of Automated Driving Systems (ADS). This will be achieved by trialling a new, more efficient, method of ADS validation called "Connected Validation" using a small fleet of production vehicles driven in real world conditions on the roads of Greenwich. In doing so, a unique "Big Data" resource of ADS data will be created in the UK which can be used to:

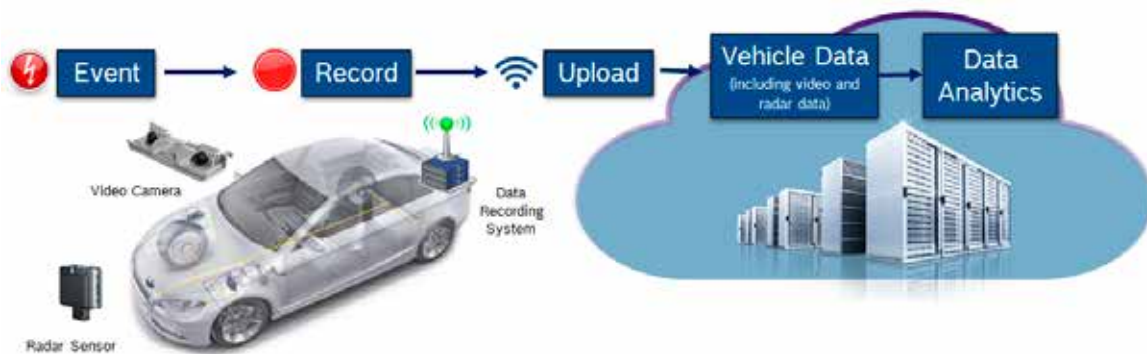
Conduct rapid, repeatable, validation and modelling of ADS

Develop ADS approval methods which could be used as a foundation for future ADS regulatory requirements/approval

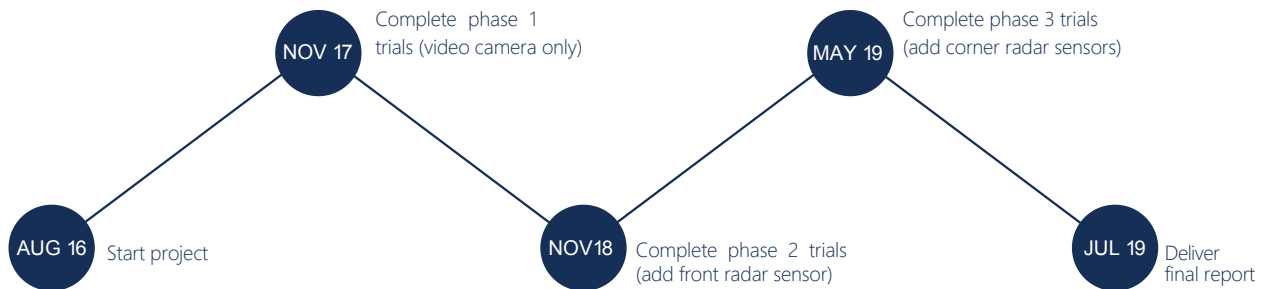
Provide insight into the impact of ADS on risk, liability, claims, and the future of the vehicle insurance industry

Provide "smart cities" with new ways to improve services for residents and the environment

Connected Validation



Milestones



Successes

- Phase 1 trials well underway
- Vehicles successfully sending data to cloud via 3G and Wi-Fi
- Over 25,000 miles covered by vehicle fleet
- 17 event triggered video sequences collected
- Over 19,000 separate speed limit sign detections recorded

Contact

Project Lead:
Simon Morley
simon.morley@uk.bosch.com

Website:
www.move-uk.com



Project Update

The project is based on the prediction of tyre pressure management on the tyre\wheel assemblies for commercial vehicles.

The consortium is made up with Tructyre (Fleet Management) Ltd, RL Automotive, University of Portsmouth and Sat Coms Catapult.

The project started on the 1st May 2016 and to date we have progressed in developing specialist software and predictive algorithms on the monitoring of tyre pressures and temperatures, and time to failure remotely, without any human intervention which is key in the management of tyres on driverless vehicles.

We have a high number of field tests currently in place, and the consortium has gone from strength to strength in gaining interest with large fleets and currently field testing the product across 50 vehicles, including vehicle manufacturers.

We are confident in the 4th quarter of 2017 we will have a commercial product for full exploitation before the project completion deadline 30th April 2018.





Tools for Autonomous Logistics Operation & maNagement

Fast, city-scale, data driven simulations to support both strategic & operational decision making and enhanced fleet management.

www.talon.world



Objective:

Develop software to optimise the operations of connected autonomous vehicle fleets at city scale



Challenges:

Assimilation of many different data sources
Simulation scaling for city operations
Real-time deployment of decision support-system



Milestones:

- June 2016 – Project commenced ✓
- Feb 2017 – First software release ✓✓
- July 2017 – Second software release ✓✓
- Sep 2017 – First trial begins
- Sep 2018 – Second trial begins
- May 2019 – Project close



Project successes:

More efficient fleet operations
Enables City Authority planning
Improved fleet user experience

Project Consortium:

Project Lead: Immense Simulations Project Manager: Carl Goves (carl.goves@immense.ai)



TALON (Tools for Autonomous Logistics Operations and maNagement) is being developed through industrial research funded from government's £100 Intelligent Mobility fund administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK



UK CITE



A project to create one of the world's most advanced environments for connected and autonomous driving. The globally unique UK Connected Intelligent Transport Environment (UK CITE) will enable automotive, infrastructure and service companies to trial connected vehicle technology, infrastructure and services in real-life conditions on 40 miles of roads within Coventry and Warwickshire. The project will establish how technology can improve journeys, reduce traffic congestion and provide in-vehicle entertainment and safety services through better connectivity.

Objective:

To trial multipath broadcasting of functionality, safety and convenience features using multiple communication methods (eg. ITS-G5 802.11p, LTE, LTE-V and Wi-Fi)

Challenges:

- Large consortium – complex WP interactions - takes time to agree direction
- Infrastructure power constraints
- Ensuring project continues to be aligned with changes to protocol, standards and technology during the project life
- Technically challenging USE CASES

Success:

- USE CASES defined
- Vehicle architecture frozen
- High level architecture defined
- Preliminary infrastructure design completed
- Cyber Security SoA report issued
- V2X Human Factors review completed
- Message warning best practice guidelines issued
- Report on existing simulation techniques, methods and tools completed
- Website launched
- Messaging and Comms. control in place
- Bench testing complete
- 1st UK LTE-V track demo complete
- Infrastructure installation started

Milestones:

- Jun 2016 – Project commenced
- Jun to Nov 2016 – System definition
- Q1-Q3 2017 – Bench testing
- Q3-Q4 2017 – Track testing
- Q3-Q4 2017 – Infrastructure Install
- Q4 2017- ... – Road testing
- Dec 2018 – Project finish



Project Lead – Claire Lewis clewis22@visteon.com
 Project Co-Lead – Chris Holmes cholme29@jaguarlandrover.com
 Project Technical Lead – Martin Green mgreen9@visteon.com
<http://www.ukcite.co.uk>



Unrestricted

Investigating the use of radar technology for environment mapping



Just as with human drivers, a vehicle must know its precise location in order to know how it should behave, where it should go next and what challenges may lie ahead. Navtech are investigating the feasibility of producing a radar based system that will provide equivalent information to the lidar technology currently being used in order to provide a sensor that is reliable in all weather and light conditions.

Objectives:

To understand the feasibility of radar for use in the University of Oxford's Mobile Robotics Group (MRG) environment mapping system

Milestones:

- September 2016 – Project launch
- November 2016 - Initial feasibility report
- January 2017 - Desktop prototype performance report
- April 2017 - FPGA and processing board development complete
- June 2017 - Two full feasibility demonstrators built
- September 2017 - Results evaluation

Challenges

- The radar must have a very narrow beam width but large elevation beam width - traditional radar techniques make sensor far too large and bulky to be commercially viable on a vehicle.
- Navtech must utilise novel radar techniques in order to meet the specified requirements using a much smaller antenna.

Project Successes

- Architecture Feasibility study completed
- Further antenna development completed with good results
- Version 1 processing board has been designed, built and testing has begun

**Project Lead: Lizzie Bellinger, Elizabeth.bellinger@navtechradar.com
01235 832419 www.navtechradar.com**

Project SAAV



SAAV (Situational Awareness for Autonomous Vehicles) is a project to explore the feasibility of implementing a generic set of hardware and software processing IP suitable for situational awareness systems for autonomous vehicles.

SAAV is jointly funded by government and industry. The government's £100m Intelligent Mobility fund is administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK.

<p>Objectives: Assess feasibility of a providing a generic set of hardware and software IP for situational awareness systems that is efficient and flexible, and can be configured easily for any vehicle. Development of vehicle with sufficient capability to demonstrate the IP set.</p>	<p>Milestones:</p> <ul style="list-style-type: none">• April 2016 – Project start• June 2016 – components sourced• September 2016 – basic vehicle operation demonstrated• December 2017 – advanced situational awareness capability integrated• March 2017 – final project outputs
<p>Challenges:</p> <ul style="list-style-type: none">• Build of low cost demo vehicle• Achieving highest levels of situational awareness processing performance with very small battery• Achieving a solution that will be usable by those without detailed domain knowledge	<p>Project successes:</p> <ul style="list-style-type: none">• Build and operation of low cost demonstration vehicle• Integrated situational awareness processor IP for high efficiency processing of optical and radar data streams.



Project Lead: Leon Wildman. contact@aptcore.com

APT CORE

Higher Performance Processors

www.aptcore.com

Atlas – Feasibility Study

Funded from the government’s £100m Intelligent Mobility fund, administered by CCAV and delivered by Innovate UK, this feasibility study will examine the data and communications requirements that power autonomous navigation, and recommend the critical building blocks required for the efficient operation of connected and autonomous vehicles.



Objective:
Research and develop data, communications, navigation and processing requirements will underpin successful deployment of CAVs.

Challenges:

- Defining the datasets required for autonomous operation.
- Examining the communication systems performance requirements in a range of operational scenarios.
- Contributing to the resilient and safe operation of connected and autonomous vehicles.
- Developing protocols for transfer of data between vehicles.
- Improving the resilience of vehicle autonomy.

Milestones:

- May 2016 – Project commenced
- Sept 2016 – Data gathering
- Dec 2016 – Data modelling
- May 2017 – Requirement assessment
- July 2017 – Final project outputs

Project successes:

- Collaboration, knowledge sharing and thought leadership with industry partners
- Developing an extended ecosystem of partners, specialists, OEM’s and others who will help develop & deliver the future of connected and autonomous vehicles.



Ordnance Survey project lead: Simon Navin simon.navin@os.uk



Autonomous Motorcycle Platform Study



Project synopsis

AMPS is a feasibility study part funded by a grant from Innovate UK won in the 2015 CAV Competition. The project explores and demonstrates the technical feasibility of an autonomous motorcycle platform.

Objectives

- Develop a test platform to enable future autonomous motorcycle development
- Establish technical foundations for autonomous motorcycle control and Advanced Rider Assistance related product development
- Identify business opportunities and establish consortia members credentials

Milestones

- May 2016 Kick-off
- Aug 2016 Initial Test Hardware Installed on Motorcycle and Simulation Model Developed
- Oct 2016 Initial Controller Designed and Tested
- Jan 2016 Platform Concept Design Finalized
- Apr 2016 Autonomous Platform Control Demonstration & Final Report

Challenges

- Developing a model suitable for controller test and development
- Development of a design methodology capable of producing a robust controller for a highly non-linear system with large parameter variations and high model uncertainty
- Providing full by-wire controls on a motorcycle and developing autonomous motorcycle test protocols

Project successes

- Effective collaboration and rapid development
- Demonstration of mule vehicle control within six months of start
- World leading investigation of autonomous motorcycle passenger experience
- Identification of early market opportunities

Project lead: Dr Torquil Ross-Martin (AutoRDUK@outlook.com)

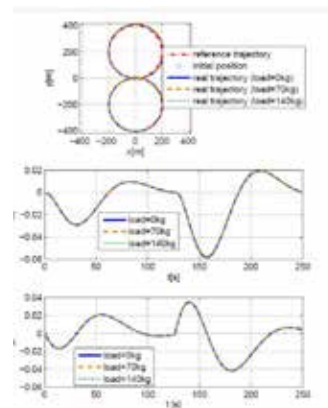
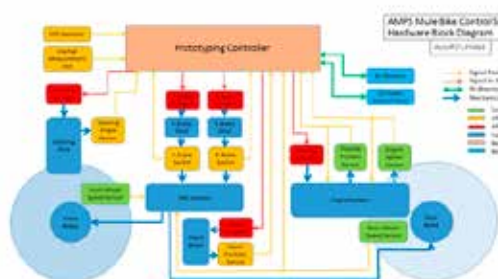
Consortia members:

AutoRd Ltd
The Road to Autonomy

EMPIRE
RACING CARS

Imperial College
London

Control Power
Technologies



CONNECTED CAR DATA CREATING NEW BUSINESS MODELS



Thingful Ltd
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thingful.net

Project synopsis

This project assesses the feasibility of real-time vehicle data sharing within a decentralised system of data producers and consumers, making use of data from the connected car. We demonstrate a system for making vehicle data accessible to a variety of third parties through an Internet of Things (IoT) system that mediates via a decentralised system, with drivers' explicit consent and incentivisation. This feasibility work will demonstrate that creating a vehicle data service for automotive after market channels, app developers and other parties (that are affected by or have a direct interest in the automotive value chain) accelerates value creation in the industry and will show how a technology like Thingful enables and supports it.

Objectives

Design, develop and test an early stage prototype of an IoT system capable of discovering and accessing sensor data feeds from a telematics system in a fleet of cars on demand, using a decentralised system design and making it accessible to third parties with varying levels of discovery and access entitlements to discover and access such private sensor data on demand.

Milestones

- Technical design documentation - May 16
- Data entitlement system for discovery and access - MVP demo - Oct 16
- Data owner system interface for entitlement management - MVP demo - Dec 16
- Project completion - Feb 17

Challenges

Designing a scalable system that makes it possible to enable differential discovery and access on the device (connected car) and its data channels and matching that up with a range of users with varying levels of permissions on discovery and access.

Successes

Developing a working system demo that makes it possible to enable differential discovery and access on the device (connected car) and its data channels and matching that up with a range of users with varying levels of permissions on discovery and access.

Project Lead



Moeen Khawaja
(COO)

Project Supported By





Driver Experience Based learning system for Autonomous Cars

Project No: 123273

Project Type: feasibility

Project Synopsis:

DEBDAC investigates means to, improve and evaluate autonomous vehicles decision-making capabilities taking into account human driver behaviour. This aims to address adopted issues in transition environments, i.e. where manual driven and autonomous vehicles co-exist. This project uses insight from mass telematics data to influence the decision making of a vehicle to 'normalise' and improve decision making in line with exemplar human behaviour.

Objective:

- Vehicle instrumentation and recording (video and telemetry)
- Monitor and record real world driving scenarios
- Analysis of real world driving as inputs for decision making
- Decision making framework
- Evaluation and dissemination of the impact human driver behaviour can aid decision making

Milestones

NOV 2016 - Project start
JAN 2017 - Requirements collection
MAY 2017 - Driving Knowledge base completion
JULY 2017 - Learning algorithms Prototype
AUG 2017 - Decision-support framework
NOV 2017 - Evaluation & Workshop event

Challenges

Use of existing driving data, evaluating inputs to decision making,

Project successes

Vehicle Instrumentation underway, driving behaviour underway

Project Contact

sam@theflow.com <http://www.debdac.com>



Efficient Autonomy Hardware

Custom computer chips will eventually contain all the 'smarts' of self-driving cars. However, producing a silicon chip is a slow process. Our project has shown how advanced computer code can be automatically turned into efficient chip designs. This allows companies developing autonomous car software to quickly produce testable, commercial hardware designs. Our work means that safety improvements should appear in mass produced cars sooner.



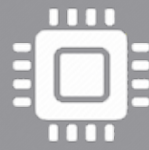
Myrtle has been taking autonomous car software and automatically making that run faster as hardware



Software in a bulky vehicle test rig is slow and needs a lot of power



We automatically translate and optimize this code to an efficient hardware design



silicon chip

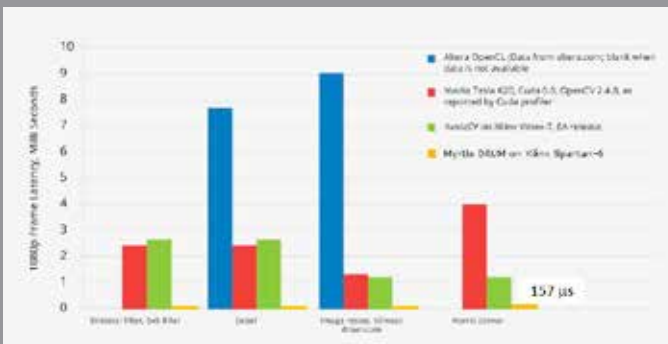


FPGA

Efficient hardware circuit design can be made into a silicon chip...

... or run immediately on a device called an FPGA. In both cases the result is much closer to market

We've demonstrated a 95% improvement over existing methods



Project results show up to a 95% improvement



Demo shows low power hardware being quickly and easily made

Our final milestone involves next generation deep learning hardware

Project video
Project lead

www.myrtlesoftware.com/case-studies/fpga
Peter Baldwin, peter@myrtlesoftware.com

Project 132269: Efficient Computer Vision ADAS Hardware for CAV



Data collection in Greenwich.

In this project, the aim is to reduce the cost of accurate, high-density 3D perception to aid autonomous vehicle operation. Lasers are currently the sensor of choice for 3D perception tasks, but they are expensive, require precision moving parts and only provide sparse data.

Stereo cameras offer a compelling low-cost alternative for 3D perception. They provide the significant advantages of high resolution and high frame rates, but current real-time stereo systems do not offer the level of accuracy that we require. They are also adversely affected by variations in lighting and weather conditions.

Oxbotica's HDV approach combines stereo imagery and sparse laser sensing to achieve high frame rate and accurate 3D perception. Currently the approach still requires relatively expensive laser hardware. The project end goal is to provide highly accurate dense data with minimal reliance on high cost lidar sensors, thereby reducing the overall cost of the system.

OBJECTIVES

The main objective of this project is to reduce the reliance on high cost lidar for autonomous operation. We will compare the results of lidar, stereo-camera and fused data to find the optimal balance between cost, accuracy and reliability on which we can operate an autonomous vehicle safely and efficiently. We will test and validate our system on many kilometres of data in urban and off-road environments.

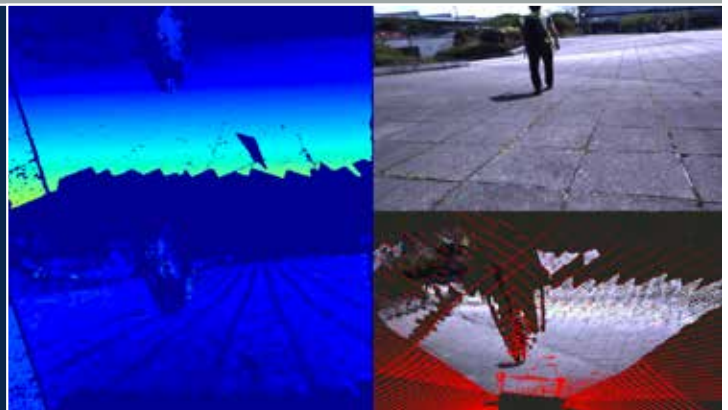
MILESTONES

- Specification & development
- Mapping, baseline & data collection
- Analysis & simulation
- Field trials, concept demonstrator

CHALLENGES

The key challenges that we predict are around how the camera/laser combination interacts with the environment:

- Stereo perception algorithms perform very well in highly textured environments, but can struggle when there is a lack of visual texture
- Reflective building materials can affect the accuracy of laser measurements
- Off-road environments contain many non-planar surfaces and depth discontinuities
- Harsh weather conditions



Output from HDV. Top right: 2D Image. Bottom right: High Density 3D point cloud constructed from stereo camera and laser data. Top left: computed disparity (brighter colours indicate objects closer to the vehicle). Bottom Left: computed disparity uncertainty (brighter colours indicate larger uncertainty)

SUCCESSSES

- Design and build of data collection vehicles to provide sufficient data for this project
- Already collected data in key environments including urban and off-road data and started the initial assessment of such environments
- Efficient knowledge transfer from the ORI research group to Oxbotica
- Successfully processing data and making changes to improve efficiency

PROJECT TEAM

- Alastair Harrison (alastair@oxbotica.com)
- Emily Williams (emily@oxbotica.com)
- Ben Upcroft (ben@oxbotica.com)
- Graeme Smith (graeme@oxbotica.com)

www.oxbotica.com

Optimised vehicle autonomy for ride and emissions (OVARE)

Nick Molden Marc Stettler
 nick@emissionsanalytics.com | m.stettler@imperial.ac.uk

OVARE is a 12-month feasibility study (2016-17) with the aim to demonstrate the concept of **optimising the driving style of connected and autonomous vehicles (CAVs) for passenger ride comfort, vehicle fuel consumption and emissions**, or journey time and speed. The project evaluates the impact of these potential customer choices on traffic, fuel consumption and emissions at the network level using traffic simulation.

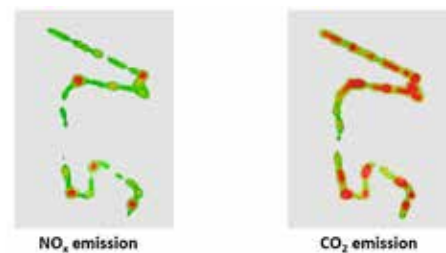
Project objectives

Specific objectives are to:

- Collect ride comfort measurements and emissions data for a large number (>20) of different vehicles
- Develop models for the prediction of ride comfort and emissions for different driving behaviours
- Demonstrate network effects of customer preferences through traffic simulations

Vehicle emissions

Vehicle emissions are a function of driving style and vehicle type.

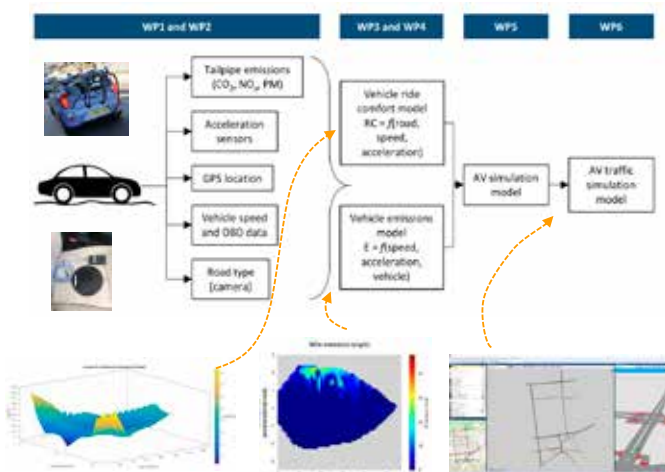


Vehicle ride comfort

Vehicle ride comfort is a function of driving style and vehicle type. Measurements match perception.

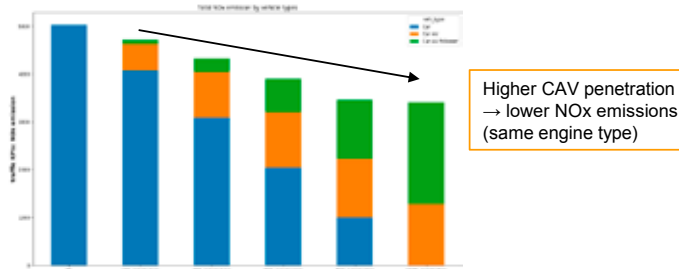


Work packages



Traffic simulations and emissions

Potential reduction in emissions with CAVs that drive more smoothly (preliminary).





People in Autonomous Vehicles in Urban Environments (PAVE)

Project Objectives & Outcomes

The primary aim of the PAVE project was to explore the feasibility of using the UKAEA’s 200 acre fenced site at Culham as a test site for Connected Autonomous Vehicles (CAV). In so far as Oxbotica now operate vehicles on the site and UKAEA have plans to expand both the numbers of vehicles and the variety of road conditions they will be experienced the project has been an unqualified success.

In addition to delivering an open-access capability the project also:

- Socialised the role that Culham could play as a fenced test site as part of a Closed-Fenced-Open CAV UK test and validation strategy. In this regard good links have been established within the sector and Culham, as a test site has been included in the plans, of a number of organisations.
- Detailed preparation for use of autonomous cars at Culham including associated use cases have been derived. The vehicles operate within a defined set of processes, on the Culham site and future use cases have been elaborated which mean that the site is able to test on an open-access basis.
- Amey (and its parent company Ferrovial) have become aware of the benefits associated with the use of autonomous service vehicles and are looking at ways of taking this interest further.
- Oxbotica has deepened its understanding of the requirements of CAV technology and the responsibilities associated with running this technology.
- Through involvement with plans for the development of the Culham Smart Community, Didcot Garden Town and Smart Oxford the team have introduced thinking on the potential impact CAV could have on future communities to substantial real-world projects at an early stage.
- We have gained insight into people’s perception of CAV and the quantified survey data collected should provide a basis for future public surveys/consultations.
- In addition the partners have begun to explore the implications of CAV needing to be considered as part of an integrated Smart community and not just as a transport/mobility technology.

Deliverables

Consultation:



Awareness about the technology and initial perceptions includes site users & general public

Animation:



Visualisation tool, available on YouTube <https://www.youtube.com/watch?v=nYtuvQM5AZw>

Pinpoint: Simple, low-cost, compact and precise localisation for highly autonomous vehicles

Autonomous vehicles need to know their location relative to the road but GPS is often not accurate enough and has failure cases. Most solutions being developed and tested today use rich 3D maps of the environment to determine the vehicle position to within a centimetre or so but the technology can be expensive, process intensive, bulky and power hungry.

Our innovation is to measure the fine 3D geometry of a small patch of road surface below the vehicle and use this as a 'fingerprint' to uniquely determine the vehicle's location.

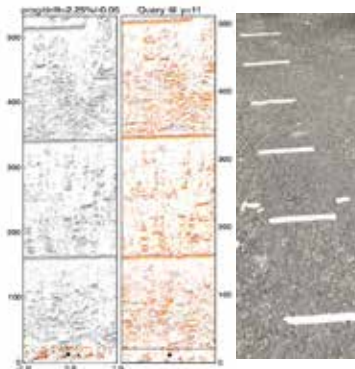
Objectives: In our project we will: i) build a prototype of the sensor, ii) demonstrate the ability to localise a vehicle and, iii) develop the commercial value proposition and route to market.

Successes:

Sensor hardware



Map and localisation software



Commercial activities



Milestones:

- May'16: Start.
- Jul'16: De-risk/proof-of-principle.
- Nov'16: Physical sensor prototype.
- Feb'17: Localisation/full system.
- Mar'17: Test at Durham Uni.
- Apr'17: Project report and end.

Challenges:

- Addressing underlying assumption that a patch of road surface segment is unique.
- Real time acquisition and processing.
- Sensor effectiveness in weather/conditions.
- Commercial barriers to entry.
- Cost of map building for all roads.

MachinesWith Vision Ltd.
www.machineswithvision.com
 Codebase, 3 Lady Lawson Street,
 Edinburgh, EH3 9DR, UK
info@machineswithvision.com

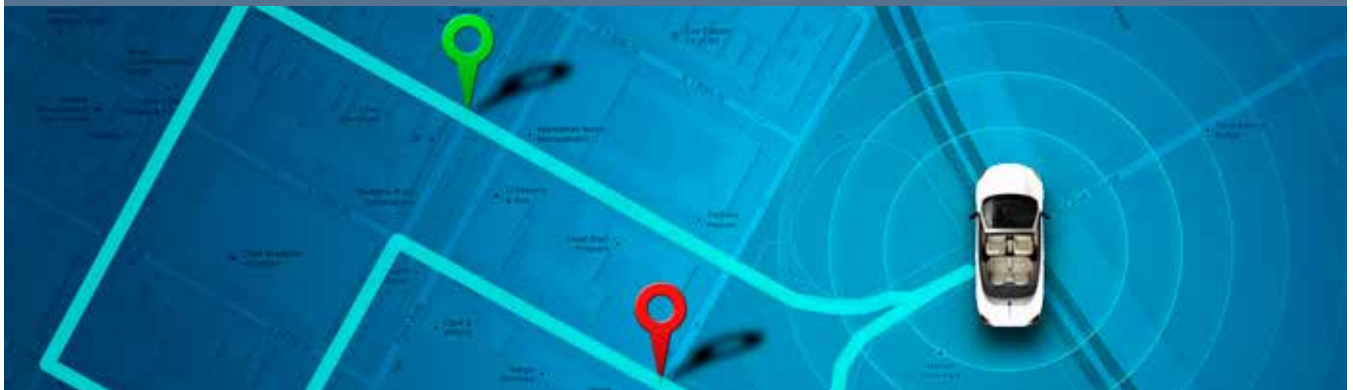


Partnered with: Durham University

Funded by the UK government's £100m Intelligent Mobility Fund administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK.

A new era of GPS-independent route tracking

Road accident 3D reconstruction



Aim: On- and off-road positioning for any vehicle to complement existing and upcoming technologies for map-independent 3D route reconstruction in real time.

Result: Overcoming the inability of GPS to operate in buildings, tunnels and under tree canopies is now possible thanks to Roke's Integrated Visual Navigation System (IVNS).

HOW DOES IT WORK?

- Inertial sensors determine velocity and orientation from motion
- Inertial drift controlled with visual information from monocular camera
- Integrated solution outperforms positioning performance of either in isolation



PROVEN SUCCESS

Connected & autonomous vehicles – The prototype system is already of interest for vehicle safety testing companies and might one day be a key component to connected and autonomous vehicles.



Wearable technology – Motivated by the need for enhanced situational awareness in urban environments, the technology has been successfully exploited by a joint collaboration involving Dstl and industrial partners in the Dismounted Close Combat Sensors (DCCS) programme.

ON THE HORIZON

- Exploitation routes include processing insurance claims and navigation for emergency services.
- Creating a prototype for supporting public acceptance through the vehicle retrofit market.

ABOUT ROKE

Roke is the UK's leading provider of research, development and consultancy in electronic engineering. We have 60 years of experience behind us and a forward-thinking team that combines some of the finest engineering, scientific and mathematical minds in Britain. www.Roke.co.uk

Virtual Validation Environment for Driver Assistance Systems (VEDAS)



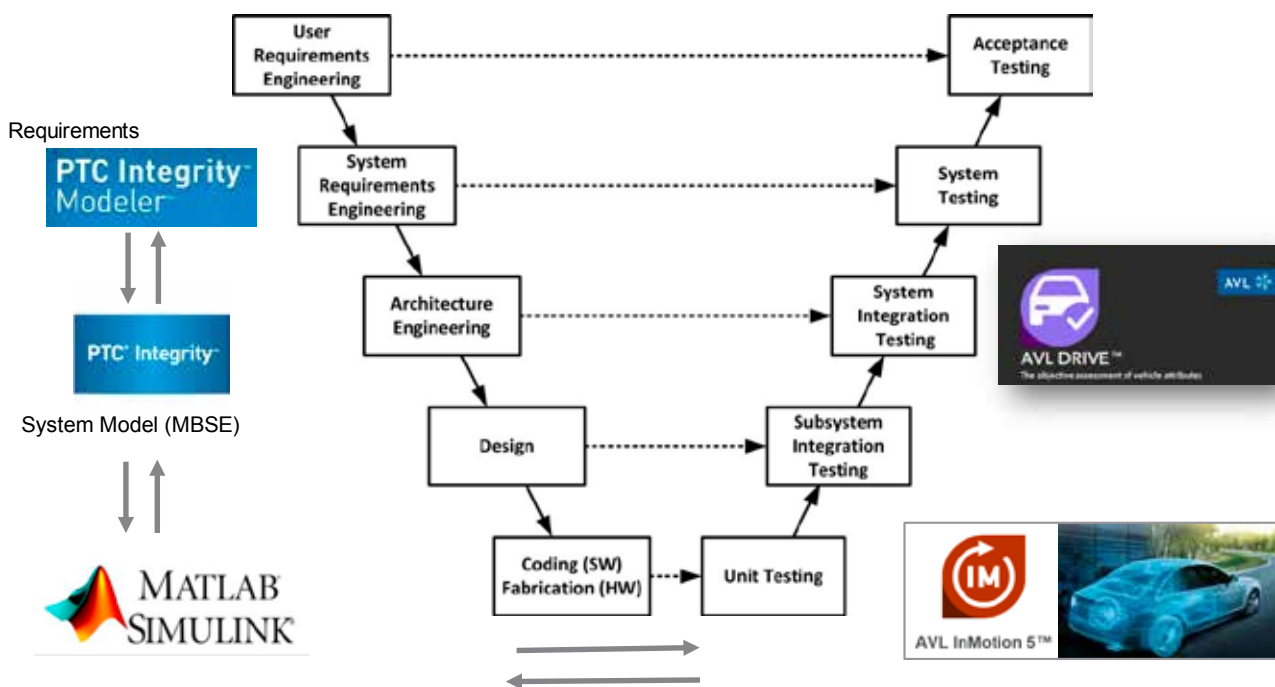
Overview:

Advanced Driver Assistance Systems (ADAS) features are becoming increasingly complex, with greater influence to the vehicle control task. Thus, the challenge of ensuring robust performance in all foreseeable use cases is becoming more challenging, detrimentally affecting the resource and therefore cost associated with validation.

This project assisted in determining the feasibility of an advanced vehicle-in-the-loop test cell by researching and developing a number of key building blocks needed in order to realise the benefits of such a test cell.

Specifically, an improved systems engineering approach was developed. This project sought to include elements such as automated and linked methods to generate test plans from a requirements document, to implement test plans into a virtual environment, and to determine the results of those tests. A virtual calibration process was also investigated.

Success in this project has led into a collaborative research project which will incorporate learnings from this project and two other Innovate-funded feasibility projects, and will further develop and demonstrate the process applied to a virtual validation facility.



In this project, AVL used their experience in development and validation of production ADAS features, identifying opportunities to address challenges facing this industry.

Processes identified and tools brought into the development strengthen our ability to deliver robust development of future ADAS and Autonomous Driving systems.

Contact:

Stuart Rowell, AVL
stuart.rowell@avl.com



Connected and Autonomous Vehicles 2

The most recent of the Competitions was launched in November 2016 and many of the projects featured in this section are in their very early stages so plans, rather than progress, are described.

Project proposals had to come up with technical solutions for connected and autonomous vehicle features that will provide real-world benefits to users. This included how these vehicles would work as part of a wider transport system. Proposals where the commercial benefit is clear were actively sought.

Again, both collaborative research and development projects and feasibility study projects were welcomed.

Proposals were invited across 4 streams:

- Stream 1 – Grand Challenge to develop and test a highly automated vehicle (SAE Level 4) capable of operating in different environments
- Stream 2 & 3 – Collaborative R&D and Feasibility Studies
- Stream 4 – Shorter, fast impact, industry-led CR&D, focus on one or more of the following priority areas:
 - Connected powertrain for more efficient energy use
 - Autonomous control for more efficient energy use
 - Business model innovation and trialling through growing supply chain relationships in the UK





Automotive Cybersecurity through Assurance

The rapidly proliferating wireless connectivity and automation of road vehicles offers many benefits to society, and significant commercial opportunity, but also brings a potential explosion of cybersecurity threats.

5*StarS partners HORIBA MIRA, Ricardo, Roke, Thatcham Research and Axillium Research will together deliver the *Automotive Cybersecurity Through Assurance* project.

Objectives

The project will:

- Research and develop an innovative assurance methodology to assure that vehicles and their components have been designed and tested to the relevant cybersecurity standards throughout their lifecycle;
- Research and develop a consumer and insurer oriented rating framework, analogous to existing Euro NCAP type ratings for vehicle safety, clarifying cybersecurity risk for the insurance industry;
- Align with relevant existing and emerging international standards and regulations.

Best practices from other sectors will be leveraged to address the challenge of establishing meaningful ways of providing cybersecurity assurance to consumers, unlocking the benefits of connected and autonomous vehicles.

Partners



Autonomous & Connected vehicles for CleanR Air (ACCRA)

Overview

Project ACCRA proposes to use CAV technology to address one of the most pressing public health issues affecting urban areas across the UK, Europe and worldwide – Poor air quality due to vehicle emissions. In the UK alone DEFRA estimate that poor air quality leads to 50,000 premature deaths per year.

Aim & Objectives

ACCRA will develop a system capable of allowing remote control of a vehicles energy management system to ensure it is running in zero emissions whilst in a designated Dynamic Control Zone (DCZ).

This area can be adjusted in location, size and time duration according to the objectives of the air quality management authority. The DCZ adjustment will be based on the real-time status of air quality in the management area which is monitored by an array of sensors and future predictions of the air quality based on weather and traffic data.

The project will demonstrate this capability in a 7.5t Range Extended Electric Vehicle (REEV) in the proposed study area in Leeds.



Figure 1 : ACCRA proposed study area

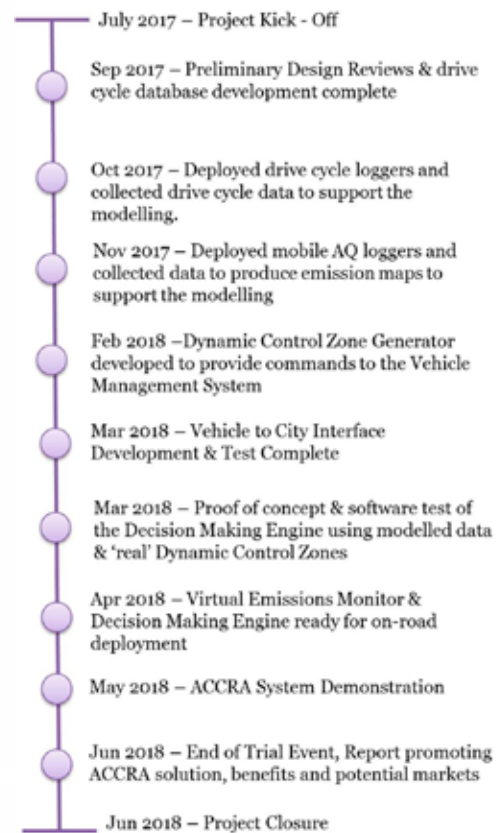
Successes

- A system able to connect vehicles, city air quality sensors and city traffic management systems.
- The development of the concept of dynamic Low Emission Zones – strategies to determine where they should be at a given time.
- Measurement of real-time air quality and present findings through simulation to inform dynamic zone strategies.
- Use of on-vehicle emissions measurement to feed into real-time decision making (active geo-fencing)
- Indirectly control select vehicles (REEV) to switch their running mode in designated zones.
- On-road demonstration of vehicle-to-city interface and dynamic zones.
- Specified roadmap for exploitation of technical, commercial and legislative enhancements to inform future strategies.

Enabled By - A strong consortium with a unique combination of assets and knowledge.



Timelines





Synopsis

CAPRI is a consortium of experienced partners from industry, academia, public sector authorities and local government, working together to deliver a complete Pod On Demand mobility service. Led by AECOM, the consortium will take forward current research and development work on Connected and Autonomous Vehicles and lead the way to the new generation of PODs that will be capable of seamlessly transferring between the on-road and pedestrian environments.

Objectives:

Collate sufficient evidence from the deployment trials and simulation testing to support PODs becoming a recognised vehicle classification for use on public roads

Develop and deliver sustainable business models for an integrated end to end mobility service to transform travel

Harness Vehicle to Everything (V2X) connectivity to enhance the POD journey experience.

Lead the way to the new generation of PODs capable of safely operating within normal traffic on public roads.

Challenges:

Verifying and validating the safety and security of the next generation of PODs for both the on and off road environment.

Engaging with stakeholders to collate sufficient evidence to support PODs as a new vehicle classification.

Success:

Building public confidence in PODs as a safe, secure and viable connected mobility service using sustainable and clean energy.

Engaging with a range of stakeholders to test the use cases for PODs to deliver end-to-end mobility solutions.

Progress UK based CAV innovation across the consortium with the support of government investment to generate jobs and support the economy

Enable consortium partners such as AECOM to lead on understanding and designing how CAVs can and will shape and change our built environment in the future.

Milestones:

Autumn 2017:

Project Start

Spring 2018:

Trial to test & validate POD performance at Filton Airfield

Autumn 2018:

First public trial of PODs – supporting public use of a car park in South Gloucestershire

Spring 2019:

Second public trial of PODs - complex densely populated pedestrianised routes at Queen Elizabeth Olympic Park

Autumn 2019:

Third and final trial of PODs - complex on-road navigational route at Queen Elizabeth Olympic Park.

Winter 2019:

Project completion



For more information contact:
nada.svilar@aecom.com

MERGE GREENWICH

“AUTONOMOUS RIDE-SHARING VEHICLES, THE FUTURE OF URBAN TRANSPORT”

WHAT

MERGE Greenwich is a ground-breaking project, led by global mobility services operator Addison Lee, that aims to re-think urban transport.

Jointly funded by the government and by leading industry partners, the project will simulate how passengers can cut their transport costs and journey times by sharing driverless or autonomous vehicles (AV) with other passengers, and how these vehicles can be integrated with buses, tubes and trains.

Over the next twelve months, the £1m MERGE Greenwich project will analyse Londoners' travel habits and design a blueprint for a scalable, commercially-viable AV ride-sharing services to fit into the city's public transport strategy and plans.



WHO

MERGE GREENWICH'S CONSORTIUM BRINGS DECADES OF MOBILITY EXPERIENCE AND THOUGHT LEADERSHIP:



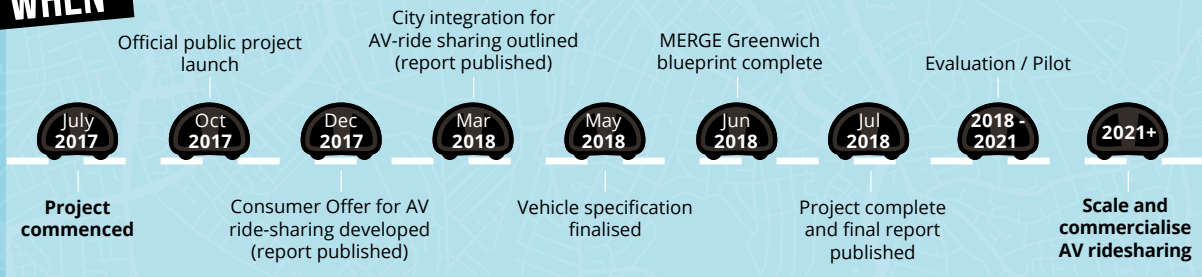
WHY

Whilst the technology for autonomous vehicles is progressing rapidly, the purpose of this project is to understand the best way to use this technology at scale for society. London has a major congestion and parking problem with single occupancy vehicles, causing delays and pollution. Autonomous ride-sharing vehicles offer the opportunity to provide the public with the flexible benefits of private vehicles and to reach areas not covered by public transport. This offers the opportunity to both improve transport accessibility, reduce the need for private vehicles and parking, and decrease the number of vehicles on London's roads.

HOW

Based at the UK Smart Mobility Living Lab in Greenwich, the consortium members will pool their expertise and experience to develop a business case for a commercially-viable ride-sharing service. The project will bring together a unique combination of public and private data to model, test and assess the most effective ride-sharing solutions. The team will also consider social, commercial and infrastructure challenges, as well as safety, security, accessibility and environmental issues.

WHEN



KEY BENEFIT

By fitting autonomous vehicles into a broader transport blueprint, we have opportunities to improve people's lives by enhancing transport provision to make it even more accessible and convenient for all. The project aims to enhance access to transport, improve choice, boost air quality and tackle congestion.

Project website: www.mergegreenwich.com

ConFIDE is a £1.8 million “connected vehicle” research and development project led by Ashwoods Lightfoot. It is funded by industry, the Centre for Connected & Autonomous Vehicles and the UK’s innovation agency, Innovate UK.

The project will develop Lightfoot Connected Car technology, which will be the only technology in the world that will fit to ANY car and truly connects it to the driver, in turn connecting the driver to an entire driving ecosystem that gives a vast array of social, economic and health benefits, making motoring cheaper, safer and greener for all. The technology will build a fun, competitive community of drivers who will be rewarded with benefits like reduced fuel usage, lower insurance premiums, better privacy and an all-round safer, more enjoyable driving experience.



This will be achieved by further developing our successful Lightfoot real-time driver coaching technology, that has been proven in the commercial fleet sector, into a full "connected vehicle" solution in conjunction with key players in the driving eco-system like insurers, breakdown providers, vehicle financing and fuels suppliers.

PROJECT CHALLENGES



Connectivity

Artificial intelligence



Hardware size reduction



Features & functionality



Server and data infrastructure & security

Partnerships and integration with driver eco-system



CONTACT

dan.regan@lightfoot.co.uk



MILESTONES

Oct 2017 – Web & server work complete

Nov 2017 – Eco-system compiled

Nov 2017 – First prototypes assembled

Dec 2017 – Real world Beta testing begins

July 2018 – Beta prototypes reviewed

Feb 2019 – Final testing & validation

DRIVEN

Insuring, Ensuring and Exporting Fleet Wide Level 4 Connected Autonomy

DRIVEN is an ambitious project that will see a fleet of fully autonomous vehicles being deployed in urban areas and on motorways, culminating in multiple end-to-end journeys between London and Oxford.

No connected and autonomous vehicle trial at this level of complexity and integration has ever been attempted anywhere in the world.



DRIVEN: The first autonomous fleet of vehicles, Oxford - London

OBJECTIVES

- First fully integrated autonomous control system platform for on-demand, insurance-driven, L4 operation of a connected autonomous vehicle
- Fleet of autonomous vehicles operating multiple journeys between Oxford and London.
- Connected risk management to optimise overall autonomous fleet safety and operation
- Secure distributed data sharing

CHALLENGES

- Reliable and robust communication across a fleet of autonomous vehicles given bandwidth constraints
- Keeping costs viable without any loss in performance
- Integrating cybersecurity, insurance and data sharing into one system

MILESTONES

- **July 2017** – Project initiation
- **August 2017** – Finalised OS platform design
- **January 2018** – Completion of V2X development
- **June 2018** – Vehicle commissioning complete
- **March 2019** – Trial planning complete
- **June 2019** – Finalised connected risk approach
- **June 2019** – Completion of data gathering
- **June 2019** – Completion of road vehicles trials
- **October 2019** – Finalised L2-L4 Selenium development
- **November 2019** – Final trial complete
- **December 2019** – Project completion

TARGET OUTCOMES

- Deploy a fleet of fully autonomous vehicles in urban areas and on motorways, culminating in multiple end-to-end journeys between London and Oxford.
- Deliver a robust and secure system built with insurance in the loop, and allowing distributed data sharing.

OXBOTICA

Westbourne

Telefonica



TRL



OXFORDSHIRE COUNTY COUNCIL

drivenby.ai | @drivenbyAI

Project lead: Oxbotica

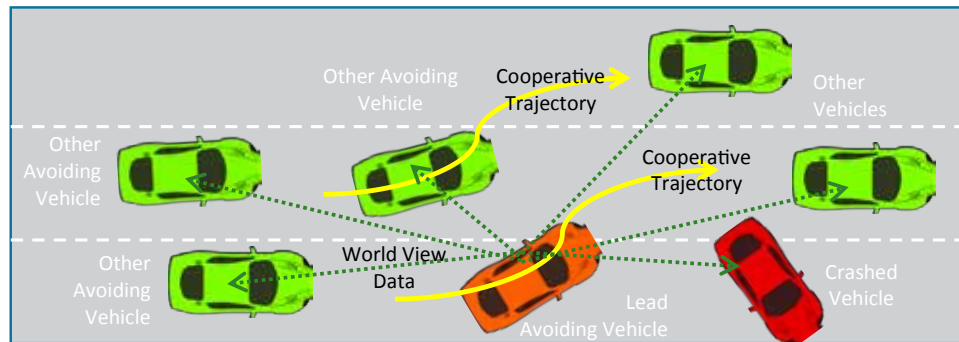


Multi-Car Collision Avoidance: using connectivity and autonomy to minimise the damage in high-speed, multi-vehicle traffic accidents.

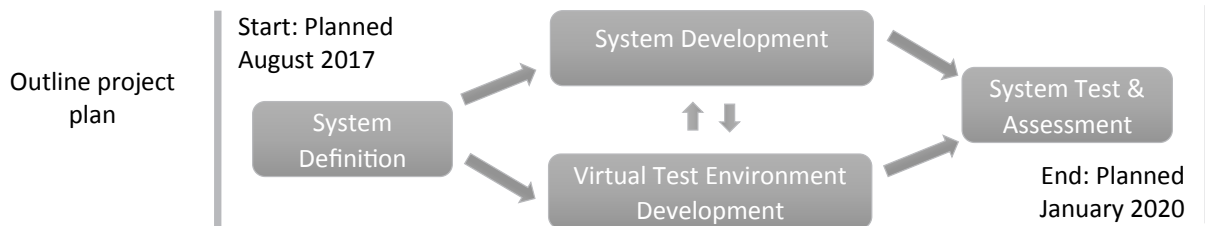
Motorway pile-ups are costly – both in financial terms and in terms of human lives. MuCCA is a £4.6m, 30-month project supported by Innovate UK, which will develop a next-generation driver aid that aims to avoid multi-car collisions on motorways. If an accident cannot be avoided, the MuCCA system will attempt to minimise its consequences (both injuries and damage).



These goals mean the project will implement, test and refine solutions to many of the technical challenges that face fully autonomous cars. These challenges include sensor systems, machine learning, vehicle-to-vehicle communications and vehicle control systems.



<p>Key Innovations:</p> <ul style="list-style-type: none"> • Cooperative decision and trajectory control for complex collision avoidance • Prediction of human-controlled vehicle paths • Shared sensor-agnostic world view <ul style="list-style-type: none"> ○ Match data from other connected vehicles to sensed vehicles ○ Merge sensor data from other vehicles 	<ul style="list-style-type: none"> • Develop insurance logging capability to support event reconstruction • Integrated simulation environment to evaluate complex crash scenarios • Cyber-security assessment for common requirements • Multi-vehicle system validation on a test track
---	---



Project Lead: Dave.Mclaren@idiada.com
 Web: mucca-project.co.uk/mucca-project.com
 Media enquiries: Mucca.project@ts.catapult.org.uk



We work with **Innovate UK**

AIR·CAR

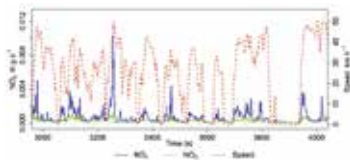
Powered by **Tantalum**
CORPORATION

The environmental effects of road transportation has become an increasing concern, fuelled by a greater understanding of the health impacts and recent vehicle emissions scandals. Local, regional and national government are developing Clean Air Zones to reduce NOx emissions.

Air.Car is a collaboration between Tantalum Corporation and Imperial College London to develop real-time NOx emissions estimation using OBD data from a connected device.

Objectives

- Develop algorithms to create a NOx library for all Euro 5/VI and 6/VI diesel engines, in order to accurately estimate real-time NOx emissions from OBD data through a connected device.
- Together with Tantalum's existing real-time CO2 emissions estimation capability develop a suite of products and services to allow the accurate estimation, management and mitigation of vehicle traffic's environmental impacts.



NOx emissions can be halved through better driving

Challenges

- Understand OEM NOx emissions reductions strategies through reverse engineering
- Creating a plug and play solution for all vehicles.

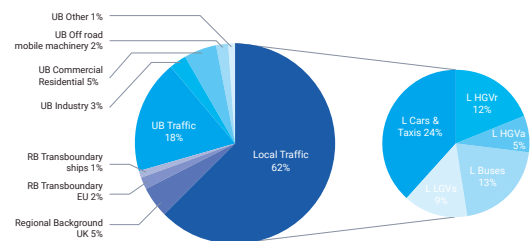
Project Success

- Accurate real-time NOx emissions estimation capability developed
- New traffic emissions models created

Project Benefits

- Service to local authorities for Clean Air Zone enforcement and emissions based road charging
- Vehicle operators able to measure, manage and reduce environmental impact through better driving
- Local authorities informed about real-time traffic emissions

NOx emissions sources



Project Milestones

- July 2017
Project Start
- July 2017 - June 2018
Vehicle Testing
- Autumn 2017
Installation of Trial Units
- January 2017
NOx Algorithm Developed
- February 2017 - June 2017
NOx Algorithm Adapted and Verified

Strategic lead: Matthew Pencharz
Technical lead: Dr Manos Hatiris
Project manager: Dominyka Zemaityte
Imperial College: Dr Marc Stettler

Imperial College
London

Innovate UK

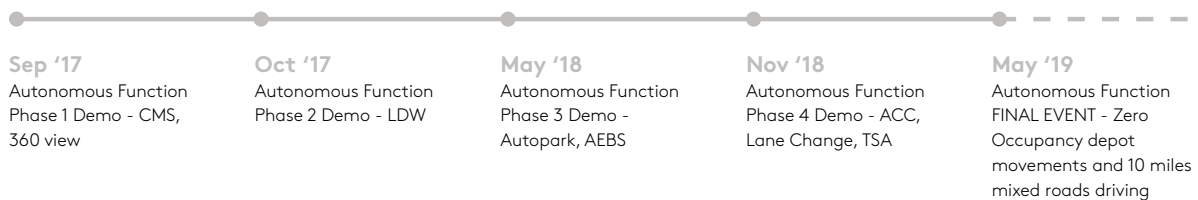
Centre for Connected
& Autonomous Vehicles

Contact: air.car@tantalumcorporation.com Or visit: www.tantalumcorporation.com



Project Synopsis

The ROBOPILOT platform will develop & demonstrate autonomous driving functionality for Arrival Automotive’s new electric T4 Light Commercial Vehicle (LCV). It brings advanced technology developed by Arrival as technical partner for the Roborace autonomous race series to the traditionally conservative commercial market. ROBOPILOT will use the considerable expertise of the project partners to develop and deliver a full assessment of vehicle safety, cyber security evaluation and hardening, and an innovative approach to verification and validation of the autonomous decision-making algorithms. Demonstration of SAE Level 4 autonomy will be over a 10-mile route on mixed public roads in South Gloucestershire, and of driverless parking/manoeuvring in UPS depots.



Objectives

- Demonstrate 10 miles of autonomous driving at SAE Level 4 on mixed roads in Arrival’s T4 LCV
- Demonstrate zero occupancy capability that can be applied in controlled non-road environments
- Apply a robust verification and validation process and tool set to the autonomous functionality
- Integrate security by design and conduct a rigorous assessment to demonstrate robustness
- Improve market knowledge and public perception of autonomous driving systems.

Challenges

- Navigating complex traffic scenarios
- Adapting to adverse weather conditions
- V2X connectivity and network availability

Contact

Project Lead: Nick Clay
nick.clay@arrival.com

PR: Victoria Tomlinson
victoria@arrival.com

For more information visit - www.arrival.com

SWARM – Self-organising Wide area Autonomous vehicle Real time Marshalling



OBJECTIVES

- The SWARM project will facilitate collaboration between Milton Keynes Council, RDM and Warwick University researchers, to develop a novel application of SWARM technologies to provide efficient and safe fleet control of Autonomous Pods. This will engender a less burdensome human supervision of the Pod system and enable the cost effective uptake of autonomous Pods, cumulating with a demonstration of a real world trial fleet in Milton Keynes
- The SWARM project will define an optimisation goal for the SWARM technology in ‘Regular’ Pods, using a rules based approach. The system will be engineered to demonstrate certain emerging behaviours, and attributes, such as
 - Platoon where possible
 - Minimise customer waiting and journey time
 - Prioritise specific user groups for collection
 - Minimise energy use / wear & tear / unoccupied trips
- The SWARM project will develop the baseline algorithm in simulations, validate the fleet behaviour by ‘vehicle in the loop’ simulation and demonstrate the effectiveness of the solution by direct comparison with the Autodrive fleet usage.

Deliverables

- The SWARM project will deliver a fleet of 5 ‘Marshal’ Pods, which will be equipped with sensors and technologies to enable them to automatically organise the routing behaviour of ‘Regular’ Pods via SWARM technologies.
- The 2 year SWARM project will cumulate in a 6 month fleet demonstration in Milton Keynes
- The SWARM project will provide a multi-site and multi-mode simulation environment in which SWARM technologies can be assessed and validated.

SWARM is jointly funded by government and industry. The government’s £100m Intelligent Mobility fund is administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK’s innovation agency, Innovate UK.

Contact: Sbrewerton@rdmgroup.co.uk

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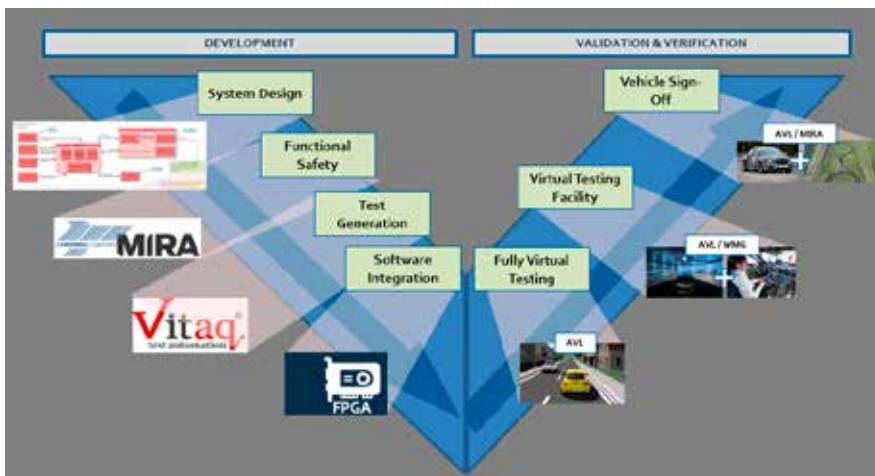
Smart ADAS Verification and Validation Methodology (SAVVY)



Overview:

The onset of advanced driver assistance systems (ADAS) and autonomous vehicles mean reduced engagement of, and reliance on, the driver in the driving task heightening the focus on robustness, safety and security. Developers seek innovative and disruptive solutions using artificial intelligence (AI) aiming to mimic human behaviour and learning, to support complex decision making in a multitude of traffic scenarios, weather conditions, interaction with pedestrians and other vulnerable road users. The importance of getting the technology right is paramount to the success and acceptance of these future systems.

The SAVVY project is positioned to address the issues highlighted. The SAVVY project will use a novel combination of state-of-the-art simulation and test technologies from AVL Powertrain UK and Vertizan Ltd respectively, WMG's unique 3xD Simulator for Intelligent Vehicles, and real-world testing facilities at Horiba MIRA to develop a cost effective and scalable approach to testing next generation deep learning AI technology as pioneered by Myrtle Software.



Contact:

Stuart Rowell, AVL
stuart.rowell@avl.com

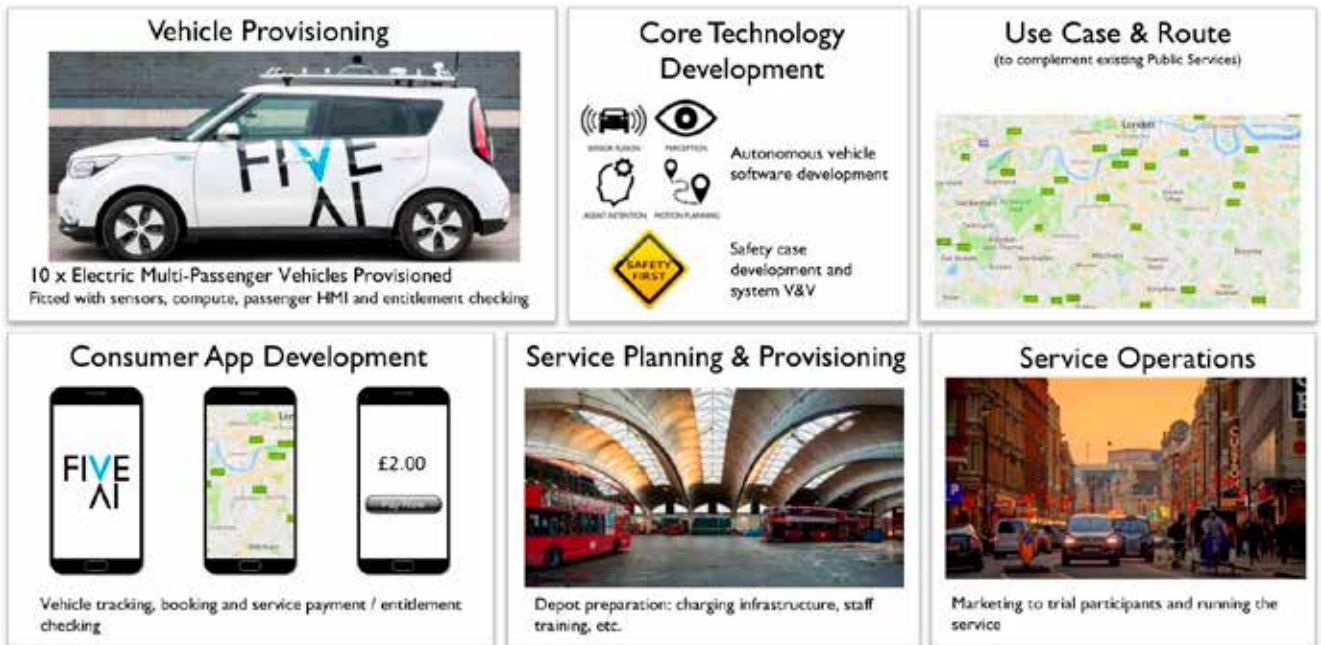
Consortium:

This 30-month project will facilitate collaboration between AVL (consortium lead), Vertizan, Myrtle Software, Warwick University and Horiba MIRA, and brings together the learning and innovations from 3 Innovate UK funded feasibility studies.



STREETWISE

StreetWise aims to develop and demonstrate the technology, safety validation methods, insurance and service models for delivering an autonomous personal mobility solution targeted at replacing the urban commuter car. The project will show that the technology is now sufficiently mature to be safe in urban environments, sufficiently intelligent to co-exist with human drivers, road users and pedestrians and will demonstrate how we can use this technology to build compelling service offers to recover commuting time, reduce commuting costs, cut accident rates, reduce congestion and cut emissions.



The StreetWise project will be delivered by a consortium led by FiveAI - a company specialising in perception and artificial intelligence technologies - working in collaboration with the Torr Vision Group at the University of Oxford, Britain's leading personal motor insurer, Direct Line Group, the Transport Research Laboratory, McLaren Applied Technologies and Transport for London.

2020 Project Objectives



5G mmWave Connectivity to Cars

Project Synopsis: This technical feasibility study considers testing, evaluating and enhancing the performance of 5G mmWave communications for Vehicle to Infrastructure applications. 5G mmWave will be explored for high data rate delivery in a vehicular environment and in particular in a motorway-speed scenario. A feasibility study to evaluate the technology for mobility will be performed. Using Road Side Units (RSUs) spaced regularly along the motorway or road, data rates in the order of gigabits per second are anticipated. To overcome the high path loss at mmWave frequencies, adaptive beamforming will be used to focus signals to and from the vehicle. The project will perform real world radio channel measurements leading to data trials using a suitable demonstration system.

Objectives

- Model the channel between the RSU and vehicle in a motorway scenario
- Demonstrate reliable, consistent delivery of data rates in the order of gigabits per second to a vehicle, and evaluate the performance at different speeds

Milestones

- Oct 2017 Trial system specification
- Nov 2017 Channel models for V2I
- Jan 2018 Beamforming and codebooks
- May 2018 Virtual drive tests
- Jun 2018 Field trials
- Jul 2018 Showcase event

Challenges

- Developing prototype RSU and vehicular mmWave communications systems
- The use of multiple antenna techniques and beamforming to high-mobility, location-aware vehicular clients
- Developing a methodology for virtual drive tests to evaluate connectivity performance

Project Successes

- Team established for Aug 2017 project kick-off

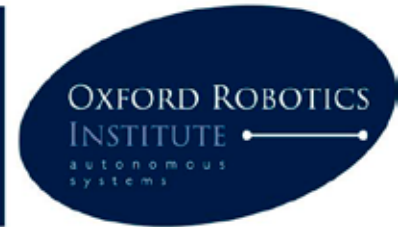


Project Lead:

Francis McCullough, Jaguar Land Rover
fmccull2@jaguarlandrover.com



5G mmWave Connectivity to Cars is jointly funded by government and industry. The government's £100m Intelligent Mobility fund is administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK.



Advancing UK Autonomous Vehicle Radar Sensing Technology

Navtech Radar will work with Oxford Robotics Institute (ORI) to develop an all-weather sensor to provide adequate situational awareness for significantly improving capabilities and safety of autonomous driving pods, already deployed on trial in Milton Keynes.

Objectives:

To access the feasibility of an all-weather sensor that can provide an adequate level of spatial discrimination for ORI's perception algorithms. Navtech Radar will design and build a demonstration prototype radar, whilst ORI develop integration and navigation code based on the radar data. Data collection and testing will then be carried out in collaboration between partners, resulting in a feasibility report.

Milestones:

- August 2017 – Project Launch
- September 2017 – Specification development complete
- March 2018 – Full software test using simulated scenarios
- June 2018 – Deliver radar prototype to ORI
- September 2018 – Final feasibility report

Challenges

- The size of the complex electronics and mechanics of the existing sensors need to be reduced without affecting the performance of the radar.
- The update rate must be fast enough to provide data of a high enough standard for the software algorithms – current sensors update 4 times every second and the target in this project is to achieve 10 updates per second.

Project Successes

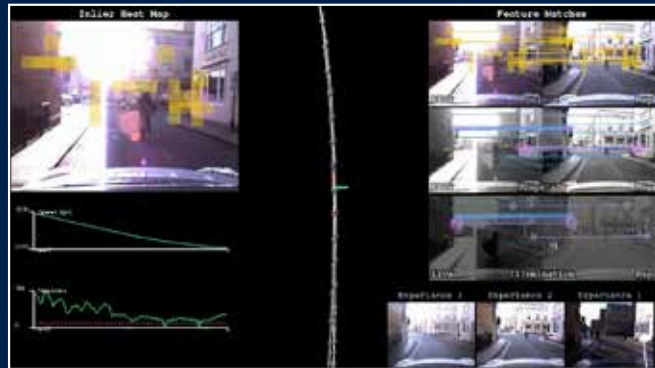
- The collaboration agreement with Oxford Robotics Institute has been confirmed
- The Project Plan and Specification have been established

**Project Lead: Lizzie Bellinger, elizabeth.Bellinger@navtechradar.com
01235 832419**

www.navtechradar.com

Autonomous vehicles require precise and continuous localisation in different surroundings, terrain, weather and at all times of the day.

This project is about performing vast-scale, vision-only localisation using Oxbotica's Dub4 software, on low-cost hardware.



Dub4, Oxbotica's vision-only localisation system running on a vehicle around Oxford, UK.

OBJECTIVES

Oxbotica's localisation algorithms will be tuned for operation on a low-cost hardware platform with no loss in performance.

CHALLENGES

- Down-costing hardware without a loss in performance
- Using 2x monocular cameras in wide baseline configuration
- Optimal mounting configuration for wide baseline cameras
- CPU and GPU optimisations
- Minimising storage requirements

MILESTONES

- Hardware installed in host vehicle
- Initial system evaluation completed successfully
- Camera Rig specification confirmed
- Software optimisation complete and specification for compute confirmed
- Platform integration complete and localisation performance confirmed
- Successful demonstration of Dub4 performance for AV localisation and vehicle tracking
- Final Report determining Technology and Commercial Road Map Complete

www.oxbotica.ai

SUCCESSES

- Can be used for autonomous vehicles, fleet tracking
- Precise localisation on a low-cost embedded device
- Accurate localisation without the use of GPS

PROJECT TEAM

OXBOTICA

- Adrian Broadhurst
- Caterina Linegar
- Chris Linegar
- Ben Upcroft

FORD

- Stelios Karagjorgis
- Dennis Witt

Cambridge Autonomous Bus System Feasibility Study



OBJECTIVES

- This 12 month study will develop and demonstrate the feasibility of an autonomous bus service which can run on segregated corridors and provide campus-related public transport services in and around Cambridge, easing congestion and reducing vehicle tailpipe emissions.
- The project partners will:
- Create a new autonomous vehicle concept and engineering designs to allow running on the guided busway between Trumpington Park and Ride, and the Cambridge Biomedical Campus;
- Undertake a feasibility study for a purpose built 'pod way' that could operate between Whittlesford Parkway and the Wellcome Genome Campus.
- Define potential route options, investigate likely user demand, consider planning requirements and create architectural concepts for a purpose built pod way in conjunction with the local authority, local residents and potential users.
- Examine multi-modal ticketing options, ticketing issues on driverless vehicles, revenue collection and protection, and fraud prevention.
- Examine the impacts on the city through city-wide demand forecasting, socio-economic impact assessments and congestion modelling.
- Create a framework to bring the project to fruition through a follow on project, including developing further partner collaborations.

CABSFS is jointly funded by government and industry. The government's £100m Intelligent Mobility fund is administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by the UK's innovation agency, Innovate UK.



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Contact: David.trausdale@amey.co.uk

Connected Autonomous Sensing Service Delivery Vehicle (CASS-DV)

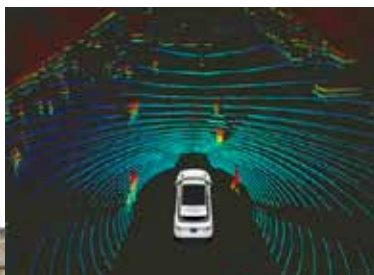
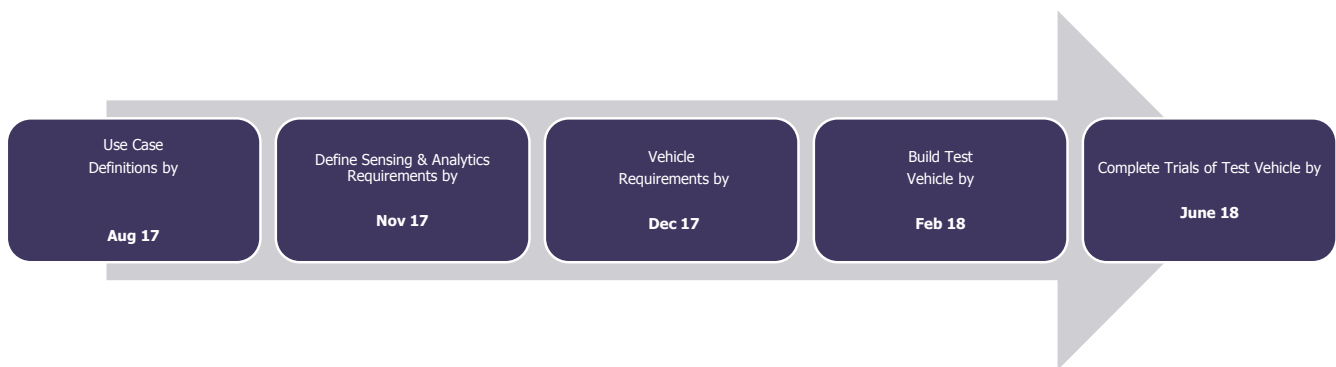
Project Outline & Objectives

CASS-DV is a Technical feasibility study to analyse and assess how emerging road based autonomous vehicle (AV) and connected vehicle (CV) technologies can be deployed across a range of service delivery areas in order to gather information about the surrounding environment. The project will deliver and trial a fully operational ground based CASS-DV prototype, integrating existing and new sensors on AVs to provide information about the surrounding environment. This information will be analysed to identify surround defects in order to aid asset inspection and management.

Challenges

- Developing a vehicle to gather enough information about its surrounding environment to be able to conduct asset inspections completed on the highways with enough granularity to highlight defects
- Working with vehicle speeds that allow the right level of information to be gathered.
- Ensuring data is processed to make it easy for asset managers to identify defects
- Gather the sensory data without compromising the ability of the vehicle to operate in autonomous (driverless) mode

Milestones



Non Intrusive Vehicle Monitoring System (“NiVMS”)

Technical Feasibility Study (132992)

Synopsis: The Non-Intrusive Vehicle Monitoring System (“NiVMS”) feasibility study is a collaboration between the UK’s first fully electric vehicle car club, E-Car Club (a Europcar Company) and automotive technology start-up AutoTrip, whose existing product range includes automated business mileage reclaim services.

From exposure to inefficiencies in the rental sector (~1.6m UK cars), and also to the efficiencies software solutions can unlock, AutoTrip designed a proprietary solution combining a number of in-car sensors, cloud computing and machine learning algorithms with the intention to offer fleet operators across the rental, leasing and hire segments improved data on vehicle condition from which a number of business benefits are anticipated.

NiVMS specifically seeks to target improved vehicle management amongst fleet operators by leveraging machine learning non-intrusive techniques currently used in energy disaggregation to evaluate whether:

- i) the same depth of insights (e.g. component level) can be discerned for cars;*
- ii) predictive capabilities can detect faults ahead of impacting usage.*

Objectives: An 18 month study will collect data from 50 rental cars (5 models, electric and internal combustion engines) via multiple sensors to:

- Validate technical feasibility via construction of a prototype algorithm and simulation on 12 months’ data collected.
- To ascertain the range of insights that can be determined from in-car sensors, cloud computing and machine learning techniques to improve fleet owners’ ability to monitor vehicle condition
- To quantify the potential impacts the NiVMS solution could offer both target customers and other key segments (e.g. insurance)
- To determine the optimum business model for selling such insights and the key partners for exploitation.

Milestones:

- Prototype algorithm developed – April 2018
- 12 months data collected from 50 car club vehicles – July 2018
- Operating statistics obtained for algorithm – September 2018
- Impact analysis – September 2018
- IPR strategy implementation – September 2018
- Refined technology roadmap – October 2018
- Business Plan developed – October 2018

Benefits: Successful execution of the NiVMS proposition is anticipated to result in a range of positive outcomes which will be quantified during the project. These include:

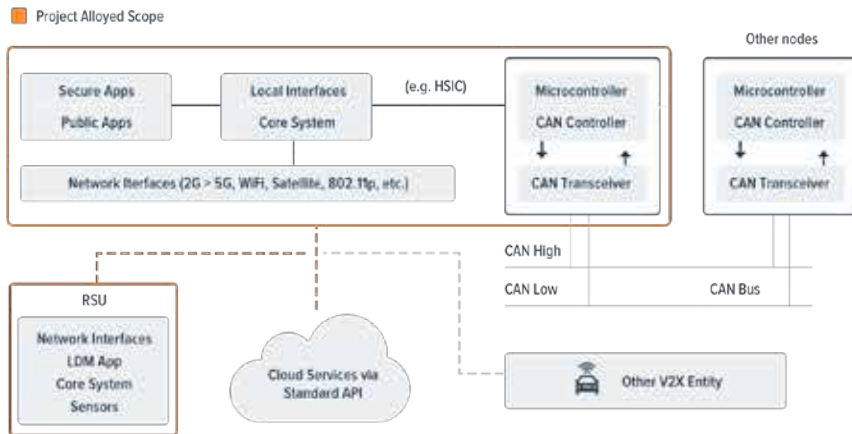
- Extended vehicle operational lifetimes
- Reduced operating costs (fleet operators)
- Improved staff productivity through automation of low skilled manual tasks (fleet operators)
- Reduced accidents and vehicle down time thanks to fault prediction



SUMMARY

Seamless. Intelligent. Fast. Safe. Independent. Exciting.

Project Alloyed will study and build technologies for vehicles of the future that will enable uninterrupted access to networks regardless of where you are, provide valuable data from within your car and its immediate surroundings and allow you to enjoy your favourite Apps and new services.


OBJECTIVES

Project Alloyed aims to conduct a feasibility study covering the technical and commercial viability of building a platform that:

- ✔ Provides a Network access-agnostic 'platform' that enables seamless V2X communications ready for existing and future access technologies
- ✔ Integrates with existing and emerging in-car systems addressing mechatronics, HMI, entertainment & information.
- ✔ Enables 'open' or 'closed' access to application and service providers for multiple use-cases

MILESTONES

- ✔ Kick-off Meeting, August 2017
- ✔ Technology Use-Case Development
- ✔ System Requirements Specifications
- ✔ System Architecture
- ✔ Proof of Concept Demonstrator
- ✔ Business Planning & Go To Market
- ✔ Fund Raising

PROJECT LEAD

Danish Alam
 Epitomical
 dalam@epitomical.com

CONSORTIUM MEMBERS











QUANTUM-BASED SECURE COMMUNICATIONS FOR CAVS

PROJECT SYNOPSIS

Over the last decade automotive components and systems have become increasingly connected and digital in nature. This trend has significantly increased the risk of malicious interference with individual components, entire cars & the overall vehicle infrastructure, and cybersecurity defences have been proven to be lacking. With a transition to connected and autonomous vehicles that is accelerating, this is the best possible time to future-proof the cybersecurity foundations of CAVs.

Crypta Labs is developing the next generation of encryption solutions, with a strong focus on those applications which if hacked can be lethal. This feasibility study evaluates the technical and commercial suitability of using Crypta Labs' quantum-based encryption to secure CAVs.

OBJECTIVES

- Develop a Quantum Random Number Generator – ECU prototype & accompanying software.
- Test the QRNG-ECU prototype in a simulated CAN bus environment.
- Perform a detailed market assessment.
- Establish relationships with early industry adopters.

MILESTONES

- Oct 2017: Envisaged project kick-off.
- Jan 2018: Finalise QRNG-ECU prototype.
- Mar 2018: Finalise market assessment.
- Mar 2018: Use QRNG-ECU to send encrypted data from a telematics ECU.
- Jun 2018: Finalise security testing at Coventry University.

CHALLENGES

- CAN bus is a relatively old technology with transfer limitations (data length, latency).
- Lack of standardisation in ECU encryption protocols (the average car has over 30 ECUs, and high-end vehicles might contain over 100 ECUs).

PROJECT PARTNERS



WWW.CRYPTALABS.COM | INFO@CRYPTALABS.COM | +44 845 880 1980



Requirement Evaluation of CAV Location Performance and Platform Development (RECAPD)

Location and sensing form two important components of CAV. Current sensing techniques have limitations when driving environments become "featureless" under bad weather conditions. The mass-market location techniques such as GNSS using code measurements and its integration with INS are unable to guarantee the required CAV location performance. RECAPD will focus on defining relevant parameters and R&D of an innovative location platform through identification of real-world location issues on a mix of UK roads.

Objectives:

The overall objective is to speed CAV deployment through Proof of Concept (PoC) of technical solutions that address essential real-world location issues to improve CAV autonomy and connectivity.

Milestones:

- Definition of required CAV location performance parameters
- Determination of the sensor system and sensor integration
- Develop processing modules and "smart" switch algorithms
- Field testing and RECAPD platform verification

Challenges:

The main challenges that we predict are around how to design a cost-effective RECAPD location platform integrating different sensors for auto manufacturers and how to develop the innovative algorithms to be able to switch to a most appropriate positioning module according to different driving environment.

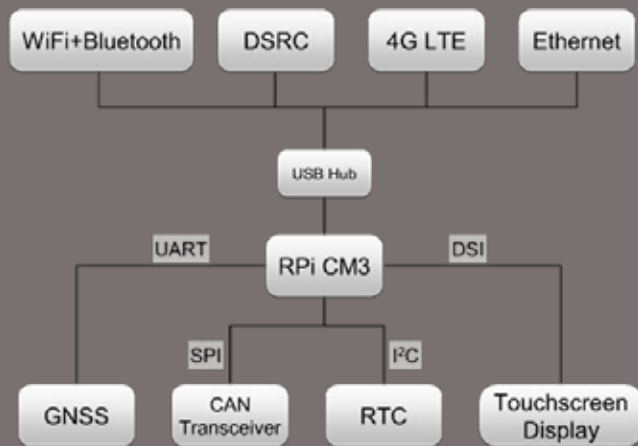


4 main CAV driving scenarios that will be classified in the RECAPD project, and RECAPD is expected to use low-cost single-frequency carrier phase GNSS receivers combined with NRTK, INS, RFID, DSRC technologies to provide ubiquitous positioning solutions.

Current work:

We are developing a hardware box combining different sensors. It is composed of three main parts:

- Communication sensors: RFID, Wi-Fi, Bluetooth, DSRC, 3G/4G module.
- Localisation sensors: U-BLOX GNSS chipset
- Processing unit: Raspberry Pi



Project lead: Jun Ye, UbiPOS UK LTD, jun.ye@ubipos.co.uk

Consortium members:

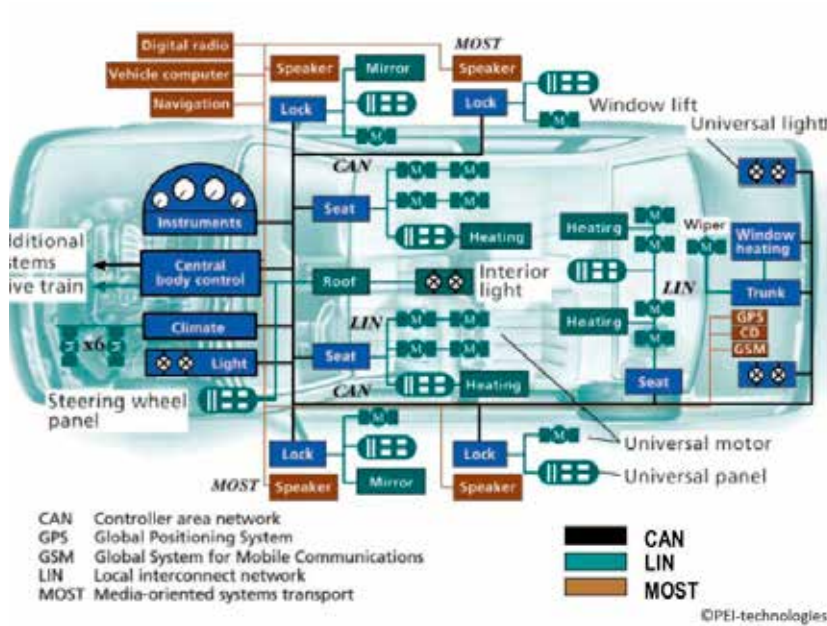


Securing in-vehicle communications



The S-CAN project is a Feasibility Study funded by the Government’s Intelligent Mobility Fund, administered by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered by Innovate UK.

As cars are equipped with ever greater numbers of electronic units, they face a growing threat of cyber attacks. If the communication between components in the vehicle is targeted, this could have catastrophic consequences. To protect against such threats, the S-CAN project aims at establishing a secure in-vehicle communications protocol over the industry-standard Controller Area Network (CAN).



Objectives

To assess the feasibility of building a secure communications protocol over the CAN using hardware-based authentication.

Milestones

- September 2017- Project start
- February 2018- Evaluation of designs complete
- June 2018 – Test of design functionality complete
- September 2018 –Project completion

Challenges

- Identifying and evaluating hardware components and protocols to achieve both speed and security of communications
- Minimising cost as well as size, weight and power of system
- Ensuring compatibility with existing CAN architecture

Project Successes

- Evaluation of architectures and security protocols
- Knowledge sharing with the automotive industry
- Identification of market opportunities

Project Lead

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 ☎ +44 (0)20 3190 5000

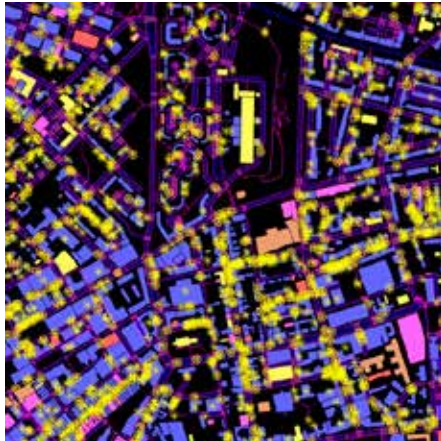
Consortia Members



Costing Mobility

Project synopsis

Costing Mobility aims to calculate the real cost of driving and its impact on the environment, pedestrians and other commuters. The project will assess the technical feasibility of “pay-per-mile” micro transactions, where vehicles will pay more to access busy or dangerous roads and be rewarded when they make environmentally friendly choices. The cost of using a given road is intelligently negotiated, through a SMART city infrastructure, between autonomous agents on behalf of the city and the autonomous vehicles. The system would even out highway usage, creating a cleaner and more efficient city for all.

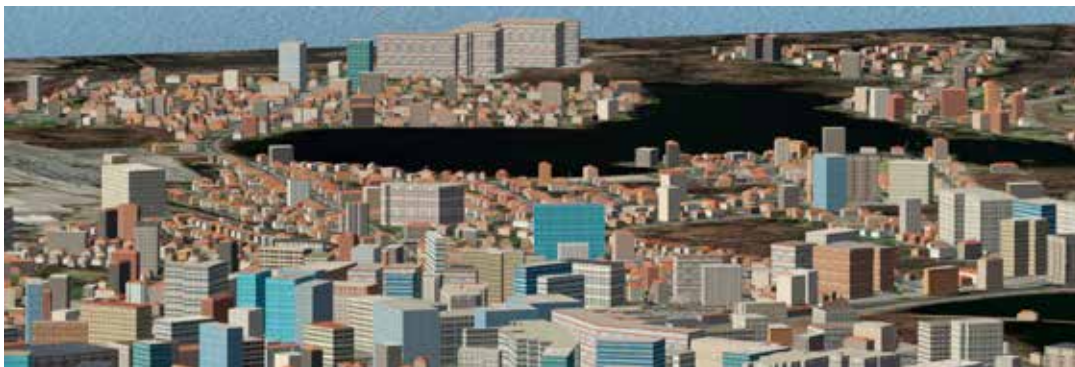


Objectives

- Create an Operating navigational system
- Create working autonomous route allocator
- Determine the correct functionality and usability of the system
- Implement exploitation and dissemination plans, including an analysis or end user requirements and potential business needs

Challenges

- Accurately representing the city simulation
- Ensure hardware/software can run the project at the scale required
- Ensure the modelling system can run efficiently with real time traffic control
- Overcome consumer and political resistance to new system

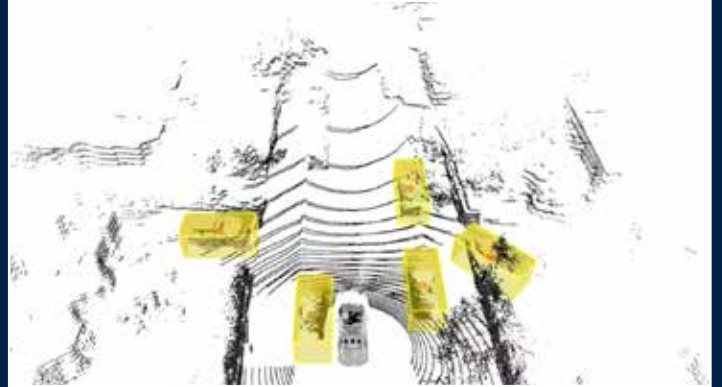


Project Successes

- A working simulator for costing transport
- Interest from councils, SMART city projects and transport authorities globally

This project intends to assess the feasibility of transferring a deep-learning research solution, Vote3Deep, from server-grade to portable systems ready for integration in connected and autonomous vehicles.

To enable autonomy, we need fast and accurate detection of objects.



Vote3Deep

OBJECTIVES

To achieve a commercially viable solution, software must be able to run in real-time with extremely high accuracy, on low cost hardware.

The translation of this research solution into a commercially viable product will be enabled through a detailed test programme at RACE (UKAEA), Culham where it will be trialled extensively both statically and in-car in a secure environment.

MILESTONES

- Vote3Deep concept proven on portable system
- Successfully integrated with tracking system
- Vote3Deep prototype proven on portable system
- Meets performance targets in validation scenario
- Development pathway defined



CHALLENGES

- Down-costing hardware without a loss in performance
- GPU optimisations
- Integration onto a vehicle, with the software running in real-time

www.oxbotica.ai

SUCCESSES

- Object detection software package transferred from high-cost server hardware to low-cost portable hardware
- No loss in performance or accuracy
- Integration onto a vehicle, with the software running in real-time

PROJECT TEAM

OXBOTICA

- Chi Tong
- Dushyant Rao
- Caterina Linegar
- Ben Upcroft

RACE

- Garry Staunton
- Rob Skilton

Horizon 2020 projects with UK participation

Carlos Moedas, European Commissioner for Research, Science and Innovation:

“Automated road transport is such a fast-moving and important area that it requires a coordinated and a collaborative approach within and between the public and the private sphere. A vast range of sectors, from the automotive industry and road infrastructure to IT and telecoms, have a role to play in exploring this new frontier.”





22 October 2015

European
Commission

Adapt!Ve
Automated Driving

Adapt!Ve develops and demonstrates new functions on cars and trucks for automated driving. The research covers several scenarios, including motorways, cities, and close-distance manoeuvres. In parallel, the project defines specific evaluation methodologies and addresses the legal framework.

// At a Glance

Project acronym:

Adapt!Ve

Project type:

Integrated Project (IP)

Programme:

7th EU Framework Programme

Project coordinator:

Aria Etemad

Volkswagen Group Research

aria.etemad@volkswagen.de

Project partners:

Vehicle Manufacturers: Volkswagen AG, BMW Group, Centro Ricerche Fiat, Daimler AG, Ford R&A Europe, Adam Opel AG, Peugeot Citroën Automobiles, Renault, Volvo Cars Corporation, Volvo Group

Suppliers: Robert Bosch GmbH, Continental, Delphi Deutschland GmbH

Research Institutes: BASt, CTAG, Chalmers, DLR, ICCS, IKA, TNO, University of Leeds, Lund University, University of Trento, Julius-Maximilians Universität Würzburg

SMEs: Alcor, EICT, WIVW

Duration:

42 months (01/01/2014 - 30/06/2017)

Total cost:

25 M€

EU funding:

14.3 M€

Project website: www.Adapt!Ve-ip.eu

// What are the targets?

Adapt!Ve designs, implements and evaluates a number of integrated applications for automated driving. The approach is based on a concept of shared control, assuring proper collaboration between the driver and the automation system in all circumstances.

The project will:

- Demonstrate automated driving in complex traffic environments.
- Focus on communication capabilities to enhance the performance of automated systems.
- Provide guidelines for the implementation of cooperative controls involving both the human and the automation.
- Define and validate new specific evaluation methodologies.
- Assess the impact of automated driving on the European road transport.
- Propose a legal framework overcoming the existing barriers to implementation.

Adapt!Ve
Automated Driving

AUTOPILOT

Automated Driving Progressed by Internet of Things

AUTOPILOT brings together relevant knowledge and technology from the automotive and the IoT value chains in order to develop IoT-architectures and platforms which will bring automated driving towards a new dimension.

FACTS & FIGURES

- ❖ **Timeframe:**
01/01/2017 – 31/12/2019
- ❖ **Project coordinator:**
ERTICO – ITS Europe
- ❖ **Consortium:**
45 partners
- ❖ **Budget:**
€25.425.252 (EU contribution: €19.924.984)
- ❖ **Programme:**
H2020 Innovation Action

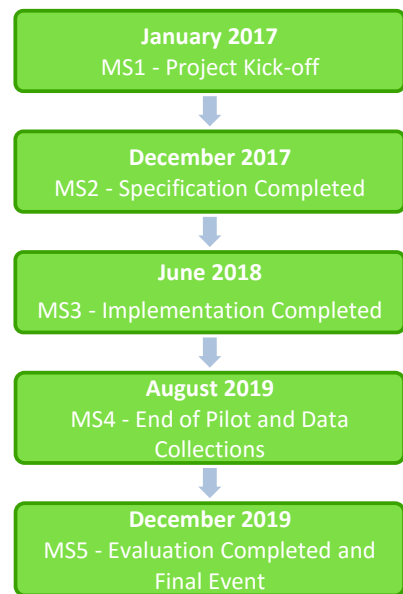
OBJECTIVES

- ❖ Enhance the vehicle's understanding of its environment with IoT sensors enabling a highly automated driving
- ❖ Foster innovation in automotive, IoT and mobility services
- ❖ Use and evaluate advanced vehicle-to everything (V2X) connectivity technologies
- ❖ Involve users, public services, businesses to assess the IoT socio-economic benefits
- ❖ Contribute to the IoT standardisation and eco-system

AUTOPILOT APPLICATIONS AND TEST SITES



PROJECT MILESTONES



CONSORTIUM



CONTACT

www.autopilot-project.eu info@autopilot-project.eu [@autopilot_eu](https://twitter.com/autopilot_eu)





Gathering top leaders from policy and industry to sketch the state of the art and major challenges on the path to automated driving in Europe and beyond



Start: 01.07.2016

End: 30.06.2018

Budget: 1 Million €

Partners: 12

Coordination: Gereon Meyer, gereon.meyer@vdivde-it.de



Start: 01.10.2016

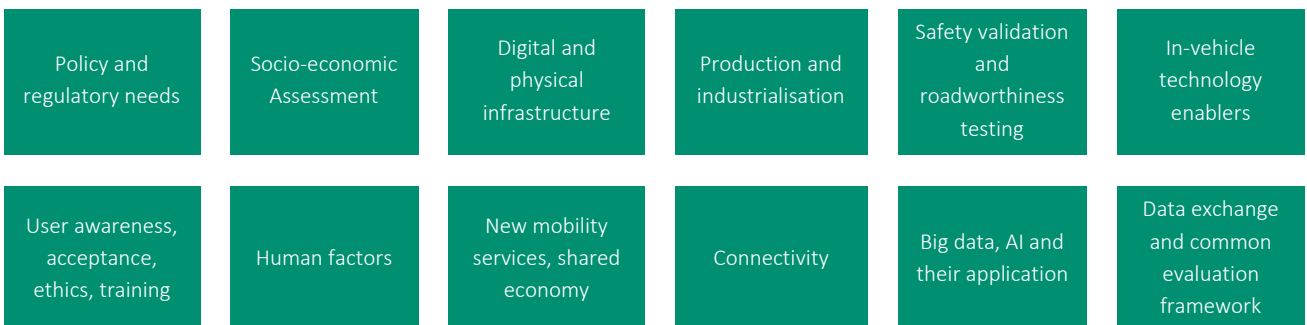
End: 30.09.2018

Budget: 3 Million €

Partners: 36

Coordination: Maxime Flament, m.flament@mail.ertico.com

Stakeholder network – Thematic interest groups – Data exchange and evaluation – Common position papers



Objectives

- **Establish** European leadership in private-public means
- **Organise** annual international conference in Europe
- **Explore** feasible use cases in line with EU strategy
- **Analyse** gaps and risks for uptake and acceptance
- **Inform** actors through comprehensive knowledgebase
- **Identify** sustainable business models
- **Support** international cooperation with US and Japan

Highlights

- **February 2017:** Expert workshop on co-creation of use cases and visions for automated driving
- **April 2017:** 1st European Conference on Connected and Automated Driving with 600 stakeholders attending and eight thematic breakout sessions
- **June 2017:** ERTRAC Roadmap on research into CAD formulated with thematic interest group input



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- 🐦 https://twitter.com/EU_CAD2017

The connected automated driving in Europe initiative is led by the CARTRE and SCOUT projects, funded by the European Union Horizon 2020 work programme



interACT – Designing cooperative interaction of automated vehicles with other road users in mixed traffic environments

The vision of the interACT project is to develop novel, holistic interaction concepts for automated vehicles, that enables their integration in mixed traffic environments, in a safe and intuitive way.

interACT will study and substantially improve the communication and cooperation strategy between automated vehicles and other traffic participants. interACT will provide an overview of current human interactions in traffic, and will support the safe deployment of automated vehicles by developing novel software and HMI hardware components for reliable and user-centric communication between automated vehicles and other traffic participants.

interACT will:

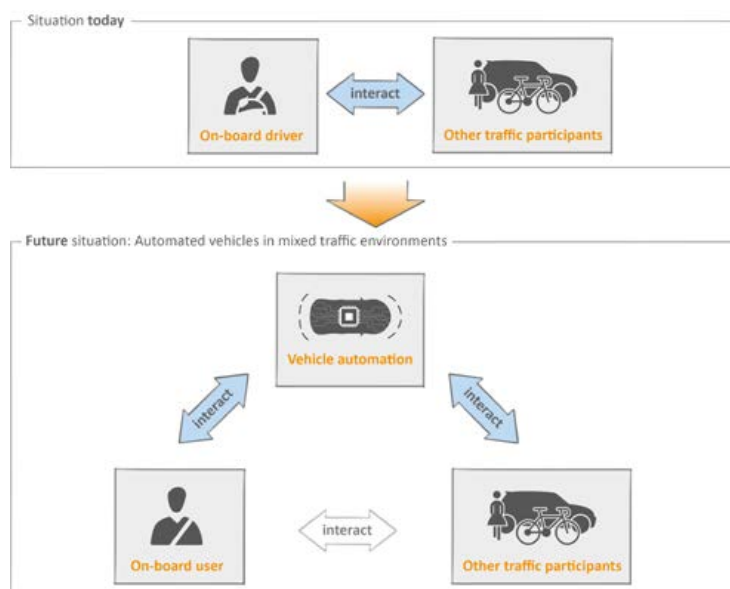
- 1) Use social-psychological models to compile a catalogue of interactions, identifying the main communication needs of road users in current and future traffic scenarios.
- 2) Improve software algorithms and sensor capabilities for assessing intention recognition and behaviour prediction of surrounding road users.
- 3) Develop a Cooperation and Communication Planning Unit to integrate planning algorithms, providing synchronized and integrated communication protocols.
- 4) Ensure safety of road users by developing easy-to-verify software for a safety layer, and novel methods for fail-safe trajectory planning.

interACT is expected to have strong impact on road safety, on usability and acceptance of automated vehicles, on their validation procedures and on the European competitiveness of vehicle manufacturers.

Project website

www.interact-roadautomation.eu

Project picture



INEA Fiche

723051 - L3Pilot

Piloting Automated Driving on European Roads

• Project description

The overall objective of L3Pilot is to test the viability of automated driving as a safe and efficient means of transportation, exploring and promoting new service concepts to provide inclusive mobility.

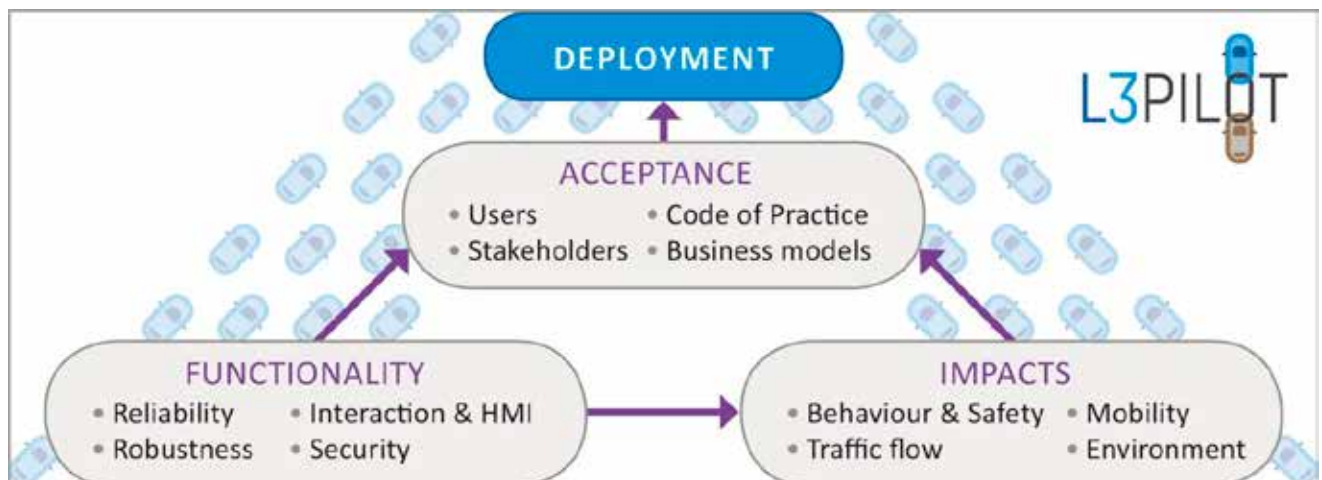
The project focuses on large-scale piloting of SAE Level 3 functions, with additional assessment of some Level 4 functions. The functionality of the systems used is exposed to variable conditions in 11 European countries, 100 vehicles and 1000 test drivers. The tested functions cover a wide range from parking to overtaking, and urban intersection driving, which will provide a valuable data for evaluation of technical aspects, user acceptance, driving and travel behaviour, impact on traffic and society.

Due to its large coverage of driving situations, L3Pilot is unique, and the first project worldwide which will demonstrate and test such a comprehensive menu of automated driving functions.

• Project website

www.l3pilot.eu is under preparation. The website will be available online from ~September.

• Project picture



Additional Projects

Details available on Innovate UK website and information expected in next iteration of this booklet

Connected and Autonomous Vehicles 2: Collaborative R&D Projects

- HumanDrive
- Electric Supercapacitor Integrated PODs (ESCIPODS)
- Project Synergy



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