16, 17 & 18 JUNE 2015
STUTTGART, GERMANY

Autonomous Vehicle
TEST & DEVELOPMENT
Symposium 2015

The world’s first conference dedicated to the testing
and development procedures for autonomous
vehicles and advanced driver assistance systems

NEW SPEAKERS ANNOUNCED - over 65 of the world’s leading experts in driverless vehicle testing are presenting papers!

www.autonomousvehiclesymposium.com
CONFERENCE OF THE YEAR!

Three days of presentations across two streams, including more than 65 industry-leading speakers!

The Autonomous Vehicle Test & Development Symposium 2015 will bring together the world’s leading engineers in the field of autonomous vehicle research, testing, validation and development. The conference will be held in Stuttgart alongside Automotive Testing Expo 2015, the world’s largest exhibition dedicated to new vehicle development and testing, and in conjunction with Traffic Technology International magazine, the world’s leading magazine for advanced highway and traffic management technologies.

Topics under discussion:
- Public road testing
- Virtual testing
- Simulation
- Traffic scenario testing
- Embedded software testing
- Safety and crash testing
- Fail-safe testing
- Cyber threat testing
- Validation and verification
- Autonomy software
- VeHIL
- V2V and V2X testing
- Robotics
- Testing legislation
- Safety standards and legislation
- Case studies
- Possibilities
- Best practices
- Reliability testing of software and hardware systems

More than 65 speakers!

Your delegate pass grants you free entry to Automotive Testing Expo!

Brought to you by the publisher of:
Day 1 Tuesday 16 June

Room A

09:00 - 12:30 - Keynote Presentations

09:00 - Testing of automated driving and cooperative interaction strategies
Prof Frank Flemisch, head of system ergonomics, Fraunhofer FKIE, Germany
This keynote will address the testing of automated driving and the cooperation of the automation with other vehicles and with humans. Starting with an introduction to the history of automated driving and a short visit to aviation automation, the levels of automation and their relationship to controllability and cooperation will be introduced as described e.g. by BAST or NHTSA. The traditional ways of testing vehicle systems and newer ways of testing ADAS, e.g. described in the CoP, will be briefly reviewed and their fitness for automated vehicles discussed. The trends and future directions of testing will be described.

09:30 - Autonomous driving from a user experience perspective
Dr Jean-Baptiste Haué, autonomous driving HMI specialist, Renault, France
HMI brings a user experience perspective to human factor issues of autonomous driving. From there, delegation also means liberty and time that the ‘driver’ will fill with life-on-board activities. The HMI for unexpected request for handover has to carefully compromise urgency and stress impact, and will presumably need some guidance. Situation awareness is the driver’s practical need for the very relevant bits of information that will inform and not distract him. Finally, users’ assessment methods have to compose with simulation to prepare as much as possible the test in real conditions.

10:00 - HMI Testing Methods for ADAS
Stefan Wolter, Vehicle Interior Technologies Ford Research & Advanced Engineering Europe, Ford, Germany
Modern ADAS and autonomous driving functions require testing of the HMI. Test procedures as used today will be presented. Furthermore, based on AdaptIVe/Response4, an outlook on future developments in this area will be given. This includes code of practice applications, expert evaluations as well as simulator studies with target customers.

10:30 - MORE KEYNOTE SPEAKERS YET TO BE ANNOUNCED!

12:30 - 13:30 - Lunch

Room A

13:30 - 18:00 - Overcoming the Challenges of Testing Autonomous Vehicles

13:30 - Delivering vehicles with certified real-world resilience to cyber attack
Andrew Ashby, business manager, automotive & transport, Plextek Consulting, UK
There is wide recognition of the threat cyber attacks pose to connected and autonomous vehicles, but less agreement as to how real-world solutions might protect, test and certify against it. How will industry give confidence to suppliers and customers alike, that a vehicle’s level of resilience to attack can be quantified, measured, certified? If the goal is to deliver robust solutions for the road, cross-industry skills must be brought together – from policy and standards definitions to cyber threat profiling, automotive manufacture, test and certification. This presentation considers what parties and skills must be brought together to address this challenge.

14:00 - Cyber security: an emerging challenge for the automotive sector
Chris Reeves, commercial manager - intelligent mobility & future transport technologies, MIRA Ltd, UK
With ever-increasing levels of automation and connectivity there is a growth in the vulnerability and risk associated with cyber security. This presentation will look at the increasing need to address this and implement mitigation strategies.

14:30 - Highly automated test solutions for camera sensors
Imre Mészáros, lead engineer, Robert Bosch Kft., Hungary
To validate the complex sensor system of an automated vehicle is not a trivial task to implement. The video camera-based sensor collects real-time information of the vehicle’s environment with an infinite number of variations. The main challenge for testers is to build up test environments that enable them to define, implement and run the tests in an automated manner and ensure portability of test cases between projects at the same time. We have developed a test solution with an automation rate up to 75% of all test cases, and running on a server-based solution that can run tests 24/7.

15:00 - V2X for autonomous driving – testing and certification approach
Jörn Edlich, senior manager business development & sales, CETECOM, Germany
The vehicle will become part of a network. By means of several mobile devices integrated in the vehicle, it will communicate with the OEM’s application servers, with emergency services, application servers of third-party providers and, in the future, with other road users. Moreover, short-distance communication via wi-fi in various forms will also find its way into the vehicle’s equipment options. The link between the vehicle and the smartphone is only one possible application, although currently the most interesting. Taken as a whole, these forms of communication make it necessary to consider the overall system.
15:30 - 16:00 - Break

16:00 - A common architecture for autonomous vehicles
Dr Charles Patchett, technical specialist - autonomous & intelligent systems, Virtual Engineering Centre - University of Liverpool, UK
An autonomous vehicle system acts as an operator substitute by making decisions to successfully accomplish its mission, based on its objectives. It has to interact with, and contextually understand its external environment and recognise opportunities and constraints that impact on achieving its objectives. This is true for its internal environment, constantly monitoring its status and health, in terms of system faults and failures, and taking appropriate remedial action, as a normal operator would be expected to do. For this, an architecture, originally based on an autonomous unmanned aircraft, has been abstracted to be applicable to all vehicles.

16:30 - Autonomous driving: testing challenges beyond technology
Volker Scholz, managing partner, mm1, Germany
Autonomous driving is becoming a concrete reality. Testing of the technology is an obvious task to tackle, but for success in the market three additional aspects require attention and careful testing: customer acceptance, business model, and legislation and social standards. The presentation outlines the challenges and possible solutions awaiting manufacturers on the way to successful marketing of the autonomous vehicle beyond pure technology.

17:00 - V2V collision warning system for high-speed track safety assistance
Álvaro Arrúe, project manager ITS, Applus Idiada, Spain
The increasing number of vehicles on a high-speed track urges the enhancement of safety for the users. These tests have an extreme range of relative speeds between vehicles and many different dynamic manoeuvres, resulting in high-risk driving conditions. The VRAIN project has designed a V2V-GNSS-based collision warning system and implemented a nomadic OBU functional prototype. The project has also designed a set of tools to aid in the development and validation of this type of safety system. This paper describes the current status and technical characteristics of the system and its main features, and introduces future enhancements.

17:30 - V2I: infrastructure as crucial element of vehicular communication
Tomé Canas, research and innovation manager, Brisa Innovation, Portugal
Wireless communications are becoming omnipresent within the automobile world, leading to a vehicular communications environment where information is exchanged between vehicles, but also with the road infrastructure, supporting safety, traffic management and infotainment applications. The infrastructure element is crucial for the success of these applications, and although the support technology is tested, the social and economic impacts are not very well known, including the business models that will support the necessary investment.

Day 1 Tuesday 16 June
Room B
13:30 - 18:30 - Best Practises

13:30 - Generic development, simulation and validation approach for ADAS systems
Alfred Kless, product manager, Vector Informatik, Germany
Precursors to autonomous drive, ADAS systems are becoming increasingly complex, integrating various sensors with sensor fusion algorithm to provide functions such as line assistance, side assistance, parking assistance and semi-autonomous driving. This paper proposes a complete ADAS development and testing approach: development environment for rapidly implementing and testing multi-sensor and data-fusion applications; high-speed ECU RAM access e.g. via microcontroller debug or data trace interfaces; rapid prototyping and real-time bypassing to speed up the development cycle on the road; comfortable ADAS road validation and datalogging solution object overlay and bird’s eye view visualisation.

14:00 - Extend the Google Test framework for safety-critical embedded systems
Ingo Nickles, field application engineer, Vector Software, Germany
Software complexity is increasing in all automotive software projects but, in autonomous vehicles the software part extends dramatically. At the same time, autonomous vehicles require error-free software. Google Test, a common open-source framework, allows unit and integration tests required by all functional safety standards. Unfortunately Google Test has limitations for safety-critical embedded applications. Software for autonomous vehicles requires automatically created test cases, hardware-in-the-loop (HIL) testing, change-based testing and the mapping of tests cases to requirements. The talk explains these methods and why they are needed, and shows an example of their implementation.

14:30 - Rules of conduct for autonomous vehicles
Dr Jacques Terken, associate professor, Technische Universiteit Eindhoven, Netherlands
When designing autonomous vehicles, in addition to creating reliable technology we need to think about how such vehicles will behave. We discuss two different paradigms: the robot paradigm considers autonomous vehicles as robots that are subject to certain norms that are accepted by society; the vehicle-as-extension-of-the-self paradigm considers autonomous vehicles as tools that act on behalf of drivers and in accordance with the needs and preferences of drivers. The question is which paradigm offers a better understanding for the design of autonomous vehicles. We will present implications of the different views and results of research addressing this question.

15:00 - Improving the robustness of GNSS-based navigation systems in autonomous systems
Guy Buesnel, market segment manager- GNSS vulnerabilities, Spirent Communications, UK
In an autonomous system or vehicle, GPS may be one of the inputs used for navigation. There are specific vulnerabilities with GPS in any safety-critical system. This presentation provides an introduction to threats to
autonomous vehicles using GNSS as a component of their navigation system. It includes an overview of likely RF interference scenarios, the spoofing threat to GNSS and an overview of GNSS receiver mechanisms, which could be used to detect anomalous events. We’ll show the importance of recreating real-world jamming and spoofing scenarios in order to test systems for robustness under the most realistic conditions possible.

15:30 - 16:00 - Break

16:00 - Software unit testing: aerospace best practices usable in autonomous vehicles?
Martin Heininger, consultant, Heicon, Germany
1) Overview of main requirements from DO178C: definition of low-level requirements, functional test cases on source code level, normal test cases, robustness test cases, structural coverage; 2) Industry-wide interpretation and implementation of these requirements in the aerospace industry: high-level-, low-level, structural coverage: target or host?, dead code versus deactivated code, why do normal and robustness test cases satisfy all needs?, test automation; 3) What this means for automotive: differences (ISO26262, similarities; 4) Final summary.

16:30 - Cost-sensitive active learning for an optimised labelling process
Beate Schwarz, algorithm developer, CMORE Automotive GmbH, Germany
ADAS systems, and camera systems such as pedestrian detection and traffic sign recognition in particular, require a huge amount of labelled data because of the need for a high level of accuracy in these systems. Manual labelling is very time consuming and, due to human error, the quality of the labelled data set is uncertain. Cost-sensitive learning reduces the cost of labelling while improving classifier performance by carefully selecting the samples to be labelled. Therefore, we propose a multi-class active learning approach that includes the optimised selection of a seed data set and an examination of different query strategies.

17:00 - Testing and safeguarding cooperative and highly automated driver assistance systems
Dr Hieronymus Fischer, head of innovations and technology management automotive division, ESG Elektroniksystem- und Logistik-GmbH, Germany
ADAS systems, and camera systems such as pedestrian detection and traffic sign recognition in particular, require a huge amount of labelled data because of the need for a high level of accuracy in these systems. Manual labelling is very time consuming and, due to human error, the quality of the labelled data set is uncertain. Cost-sensitive learning reduces the cost of labelling while improving classifier performance by carefully selecting the samples to be labelled. Therefore, we propose a multi-class active learning approach that includes the optimised selection of a seed data set and an examination of different query strategies.

17:30 - Over-the-air testing and certification for connected vehicles
Dr Pascal Hervé, R&D manager, CSA Group, Germany
Connected vehicle technologies aim to tackle some of the biggest challenges of the transportation industry in areas of safety and environment. As wireless technologies require taking stochastic combinatorics via the variation of sensor methodology for reproducible scenario-based testing, cooperative ADAS and autonomy functions envisages a methodology for reproducible scenario-based testing, taking stochastic combinatorics via the variation of sensor data into consideration.

Day 2 Wednesday 17th June

Room A

09:00 - 11:45 - Overcoming the Challenges of Testing Autonomous Vehicles

09:00 - V2V and standalone sensor fusion strategies
Dr Ryan Yee, associate, Exponent, USA
In August 2014 the NHTSA released an Advanced Notice of Proposed Rulemaking on vehicle-to-vehicle (V2V) technology, outlining its benefits and potential contributions to improving safety. Naturally, combining data from V2V and existing standalone sensors such as radar can improve the probability of detection while reducing the number of false alarms. This talk will present several data fusion strategies that can be implemented, and experimental test plans to validate such a setup.

09:30 - ADAS and its testing – the forerunner to autonomous cars?
Steve Boyle, managing director, Moshon Data, UK
Industry must prove that the cars are safe to occupy the same space as current road vehicles. Confidence in individual ADAS applications will give the trust and understanding that they are safe, and pave the way for autonomous cars.

10:00 - The challenges on the way to highly automated driving
Matthias Stiller, head of testing cross-divisional systems, Continental Teves AG & Co OHG, Germany
The presentation will discuss concepts concerning architecture for highly automated driving, evolution from driver assistance systems to highly automated driving, challenges for validation and verification concerning highly automated driving.
10:30 - 10:45 - Break

10:45 - Future testing of automated and connected cars
Tim Edwards, principal engineer, MIRA Ltd, UK
There are two fast-moving trends in the automotive sector: the increase in automated control systems and the parallel increase in vehicle connectivity. In this presentation we will consider the impact these trends will have on systems engineering and test processes.

11:15 - ADAS testing with the UFO testing system
Markus Schmidl, COO, Dr Steffan Datentechnik GmbH, Austria
The presentation will discuss technical demands on testing systems for ADAS testing, practical demands on testing systems for ADAS testing, technology of the UFO testing system, practical applications and examples of practical testing scenarios.

11:45 - 12:45 - Lunch

Day 2 Wednesday 17th June
Room B

09:00 - 11:45 - Development Tools & Development Possibilities

09:00 - Testing automotive radar in complex scenarios
Herbert Schmitt, product manager, Rohde & Schwarz GmbH & Co KG, Germany
In this presentation the influence of transmitter parameters on the accuracy, resolution and probability of detection of automotive radar sensors is discussed. Industry-leading solutions for transmitter characterisation and radar target simulation, which brings complex life scenarios of field tests into the laboratory, are presented to verify the capabilities of a radar sensor. These solutions test the entire radar including RF, baseband and signal processing, and will enhance research and future developments in automotive radar.

09:30 - Reliability testing of hardware systems for autonomous self-driving vehicle
Swapnil Deshpande, lead project engineer, John Deere Technical Centre, India
The aim of this paper is to consider the issues and challenges in reliability testing of autonomous vehicles’ hardware systems. The ultimate objective is to evaluate the reliability and service life of electrical and electronic components that are subjected to a combination of multiple loadings, which can take the form of mechanical, thermal, chemical, dust or electrical inputs.

10:00 - FASTEST: A driver assistance system for test drivers
Dr Stefan Wappler, senior systems engineer, Berner & Mattner Systemtechnik GmbH, Germany
Part of the development process of modern vehicular control systems is the technical evaluation of the sensors, actuators and already available control logic regarding their suitability and current maturity for the targeted functionality. Usually, the execution of driving manoeuvres performed for this evaluation does not occur completely systematically,

creating uncertainties regarding the coverage of situations to consider, the aspects to assess and the interpretation of the results. This paper presents FASTEST, a new method for the systematic specification and execution of test drives, aiming to reduce the mentioned uncertainties and increase the quality of the results.

10:30 - Agile Connected Test Intelligent Vehicle
Dr Craig Shankwitz, principal R&D engineer, MTS Systems Corporation, USA
The Agile Connected Test Intelligent Vehicle (ACTIV) replaces foam, balloon or strikeable surrogate vehicles for ADAS and autonomous vehicle testing. This high-performance vehicle uses active ground effects to provide lateral and braking accelerations greater than 2 g, and longitudinal acceleration greater than 1.5 g. Based on a normal road car, this vehicle provides realistic visual and sensor cross-sections. ACTIV uses a redundant sensor and wireless communication network to estimate crash likelihood during the test protocol execution. High performance allows the test to run with a high crash threshold, and supports a safe abort if the threshold is exceeded.

11:00 - Interactive real-time driving simulation for assistance system development
Michael Kleer, scientist, Fraunhofer Institute for Industrial Mathematics ITWM, Germany
In the development of fully autonomous operation of vehicles and commercial machines, the driver influence has yet to be considered. A human-in-the-loop concept allows studying a wide variety of subjects: vehicle configurations, assistance systems, the operator’s influence on energy consumption, durability, efficiency and autonomous driving and operation functions. In this presentation the Fraunhofer Robot Based Driving and Operation Simulator (RODOS) is shown as a tool to develop advanced assistance and automation systems that are preliminary steps to fully autonomous machines.

11:30 - Q&A

11:45 - 12:45 - Lunch

Day 2 Wednesday 17th June
Room A

12:45 - 17:30 - Virtual Testing Opportunities for Autonomous Vehicles

12:45 - Challenges for software development and test for autonomous automotive control
David Bailey, group leader embedded software solutions, ETAS GmbH, Germany
An overview of the current hardware and software architectures proposed for autonomous driving control systems will be presented, along with the challenges that these will bring to software development test and validation processes. The requirement to bring agile software development techniques into automotive while addressing the ASIL-D level, ISO26262 and enhanced security requirements of permanently online safety-critical systems will also be discussed.

www.autonomousvehiclesymposium.com
13:15 - Embedded systems testing and simulation with Expecco
Florian Friederich, head of sales and marketing, eXept Software AG, Germany

13:45 - Autonomous vehicle testing: HIL approach with four-hub AD dyno
Julien Faedda, technical engineer, Dynosens, France
Rotronics is well known for delivering vehicle and engine testbeds. Testing autonomous vehicles requires additional simulation to let the vehicle drive and face many different simulated situations, and check proper reactions. By mixing simulation and real testbed interface with vehicle hubs (four AC dyno) we intend to demonstrate that the global package will react accurately on the road.

14:15 - Virtual testing using probabilistic radar sensor simulations
Robin van der Made, product manager, TASS International, Netherlands
With the increasing deployment of ADAS and the ongoing development of vehicle automation, efficient ways of validating such systems are becoming a crucial part of the development process. Simulations are an important addition to field trials as they facilitate an early and automated evaluation. In this presentation, a probabilistic methodology for simulating radar sensor data is presented. The objective of this approach is to increase the simulation’s level of realism while maintaining both flexibility and adaptability of simulation-based validation strategies. The probabilistic sensor models are compared with real data in order to evaluate the statistical characteristics of both datasets.

14:45 - 15:00 - Break

15:00 - Virtual and physical test platform for skid-steered unmanned ground vehicles
Rodrigo Felix, researcher, Cranfield University, UK
As the presence of unmanned vehicles in many areas of industry and security increases, so does the need for manufacturers to guarantee that their products behave and perform as expected. This is no simple task, as the special nature of unmanned systems requires bespoke testing facilities for software and hardware to be designed and constructed. Furthermore, training systems need to be put together to prepare would-be operators for their missions. The present work will describe the design and construction of a test system concept for skid-steered unmanned ground vehicles used to test software, hardware and operator in harmony.

15:30 - Virtual testing and validation of ADAS using real-world scenarios
Michael Wagner, research assistant, Verkehrsunfallforschung an der TU Dresden GmbH, Germany
This paper describes a methodology to test and validate/assess ADAS of (future autonomous) vehicles using real pre-crash scenarios developed on the basis of GIDAS data. Within the paper the simulation model for the creation of these pre-crash scenario simulations, as well as implementation interfaces for ADAS or 3D environments, will be explained. Furthermore, it will show the future developments and possibilities in simulation of near-miss collisions (false-positive tests). The simulation of real accidents and incidents as well as the influence of ADAS is a beneficial method to assess, evaluate and develop future safety systems with regard to autonomous driving.

16:00 - Open rapid prototyping and hardware-in-the-loop testing systems
Anish Anthony, principal engineer, Concurrent Real-Time, USA
Achieving an open system architecture for hardware-in-the-loop (HIL) testing; decoupling modelling software, test automation software, target hardware as well as I/O; standardised interfaces FMI and ASAM; Concurrent’s SIMulation Workbench – an open-architecture HIL system; latest COTS hardware platforms; multi-core, multi-rate support (32, 64 cores); models and I/O can run on different cores; real-time Linux (32- and 64-bit); multi-vendor software and hardware integration; platform-independent client tools; Java, Python and MATLAB APIs.

16:30 - Testing autonomous driving systems – GNSS simulation eases testers’ lives
Werner Lange, president & CEO, Lange-Electronic GmbH, Germany
GNSS RF signal simulators offer absolute control of the GNSS RF signals. The tests can be repeated as many times as necessary with identical conditions. Moreover, a simulator offers complete control across the scenario, and every single detail can be controlled and changed. In RF simulators, comprehensive error models are available for satellite signals and clocks, satellite orbits and health flags, obscuration and multi-path, atmospheric conditions, antenna characteristics, vehicle dynamics, leap seconds, jamming, etc., and each of them can be controlled by the user individually. Some tests, such as unhealthy satellites or future constellations, cannot be tested in live sky test.

17:00 - Test-focused development for high-quality software
Ingo Nickles, field application engineer, Vector Software, Germany
When organisations are designing a physical product, a lot of time is spent in designing the manufacturing process, and the automated testing of each completed item. What if the same approach were taken with the development of software? How do we get to this point? The following approaches will be discussed: scrutinise software requirements, separating control and data requirements, if the same approach were taken with the development of software? How do we get to this point? The following approaches will be discussed: scrutinise software requirements, separating control and data requirements, coding style and architecture to improve ‘testability’, peer review. Best practices for improving software quality will also be discussed.
Day 2 Wednesday 17th June

Room B

12:45 - 16:15 - Validation of Test Results & Data Management

12:45 - Validation of advanced driver assistance systems
Karl-Georg Esser, CTO, ViGEM GmbH, Germany
Advanced driver assistance systems are finding their way into series production. These safety-related systems must be secured with hundreds of thousands of FOT kilometres. Today an eight-hour test drive easily produces 4TB of data. Vehicle bus communication and data from sensors, cameras, radar, laser scanners, etc., and their related control devices must be recorded losslessly. Then the data must be downloaded without causing longer breaks, transported, categorised, archived and be deployed quickly if required. The sheer amount of data makes new demands on measurement technology and data handling. The presentation introduces solutions and concepts for meeting the requirements.

13:15 - Challenges and concepts for validation of highly automated driving
Dr Michael Helmle, senior expert system development, Robert Bosch GmbH, Germany
Highly automated driving functions will for the first time release the driver from permanently controlling and supervising the vehicle. Consequently a system offering highly automated driving has to provide the maximum safety in all thinkable critical situations. The assurance of system safety is a formidable task and the concepts have to be shaped in order to cope with this task. We highlight some particular challenges and discuss the role of a qualitative and quantitative argumentation and of virtual testing approaches.

13:45 - Automotive radar target simulation and sensor qualification
Dr Steffen Heuel, technology manager automotive and A&D, Rohde & Schwarz GmbH & Co KG, Germany
The all-weather capability of radar sensors is an important argument for their usage in many automotive applications. Accuracy and resolution depend on the radar sensor and waveform itself. Automotive radar applies continuous wave signals with digital beamforming techniques, which allows measuring range, radial velocity and azimuth angle unambiguously and in multi-target situations. These high-performance sensors and the demands of the automotive industry require reliable and fast test and measurement solutions to ensure proper functionality. This presentation addresses modern test solutions for research, development and production of radar sensors from signal generation and analysis up to radar target generation.

14:15 - Autonomous driving robots in a private LTE network
Dr Andreas Streit, managing director, mm-lab GmbH, Germany
The operation of autonomous driving robots results in strict requirements for the wireless communication infrastructure: the network must be controllable and very reliable, and has to provide high bandwidth at very short latency times and long range. LTE matches these requirements at very good cost-value ration, because standardised, mature COTS equipment can be used. mm-lab propagates the usage of local, privately operated LTE network infrastructure as mobile communication environment for the management of vehicles on proving grounds. We have performed autonomous robot driving tests in a locally set up LTE cell with great success.

14:45 - Improving testing efficiency and software quality with change-based testing
Ingo Nickles, field application engineer, Vector Software, Germany
Instead of debugging, software developers should run every test on every software change prior to the integration. They often don’t have the ability to do this, because running all tests takes a long time, many tests are complicated to run, and test results are difficult to interpret. Change-based testing (CBT) analyses each code change against all existing test cases. Test execution times are reduced, and feedback on the impact of the changes is earlier received. The presentation will discuss: reducing test time, reducing QA efficiency, improvement of infrastructure utilisation, improvement of time to market, quality improvements and business cases.

15:15 - Embedded navigation modules for automated driving and vehicle testing
Dr Fabian Müller, researcher, Fraunhofer-Gesellschaft, Germany
The presentation will cover current results of research in terms of embedded navigation, control and mission handling of automated and autonomous platforms or vehicles, which can be applied, for example, for reproducible manless vehicle testing manoeuvres. Aspects of GPS-based localisation using EKF, track control methods and a mission planner software will be addressed. Furthermore, results from the Eurostars project AVATARES will be presented, the goal of which was the development of an automated platform for the assessment of driver assistance systems.

---

BOOK ONLINE NOW!
3-DAY PASS €1,050
2-DAY PASS €950
Day 3 Thursday 18th June

Room A

09:00 - 12:30 - Virtual Testing Opportunities for Autonomous Vehicles

09:00 - The use of interactive VR simulation in autonomous car R&D
Dr Brendan Hafferty, regional general manager, Forum8, UK
The application of real-time interactive 3D VR simulation and modelling software in the research and development of autonomous vehicles will be discussed. This will include: the integration with traffic and pedestrian simulation, simulation of camera and laser sensors, auto generation of driving simulation ready roads from GIS of GPS log data, modelling of the infrastructure and its equipment, and integration with simulation of V-to-V and V-to-I communications.

09:30 - Model-based testing and automation for autonomous vehicle software validation
Xavier ROUAH Rouah, Lead Software Engineer, Intempora, France
ADAS and autonomous vehicles software validation requires lots of efforts and driven kilometres with limited possibility to cover all the situations the system will have to face. The French project COVADEC addresses this issue by developing new techniques and tools to reduce such validation efforts in accordance with ISO26262. Some techniques integrated in a complete software toolchain: model-based testing (MBT) to generate test cases at minimum cost while achieving better coverage of the scenarios, simulation and real sensors data playback for a complementary approach, test execution automation. COVADEC partners are PSA, Valeo, All4Tec, Intempora, Magillem, Civitec, Armines and Tima.

10:00 - An integral approach to autonomous vehicles development V-cycle
Dr Igor Passchier, senior technical specialist, Tass International, Netherlands
The complexity of cooperative and automated vehicles increases exponentially compared with traditional vehicles. An integrated tool suite supporting the full-development V-cycle is crucial to enable cost- and time-efficient development processes. This paper presents such an integrated tool suite. It includes state-of-the-art simulation platforms for active safety and automated systems. Hardware-in-the-loop testing is provided for sensor and communication systems, while a dedicated test environment is provided for rapid, safe and reproducible testing of cooperative and automated vehicles. For system validation and performance testing, a test site for urban, interurban and highway is available.

10:30 - Virtual validation of V2X-based driver assistance systems
André Rolfsmeyer, lead product manager, dSPACE GmbH, Germany
Growing comfort and safety requirements are enormous challenges for the automotive industry. In response, an increasing number of active safety and driver assistance systems are being introduced. V2X communication is part of the next generation of these systems. To validate V2X functions, various traffic situations and specific properties of the radio link have to be taken into account. These scenarios cannot be tested adequately by means of real test drives because of their complexity, the effort involved and poor reproducibility. This paper presents a simulation environment for validating V2X-based driver assistance systems by means of virtual test drives.

11:00 - Driver-in-the-loop simulation for autonomous vehicles?
Phil Morse, technical liaison, Ansible Motion Ltd, USA
Many demands are placed on real-time vehicle simulations, such as those required for human-and-hardware-in-the-loop (H2IL) interaction. Since the fidelity of these simulations is often regulated by subsystem modelling and data exchange efficiency, special techniques have been developed to create simulations with enough sophistication to accurately describe vehicle dynamics scenarios, while being computationally efficient enough for real-time interaction with human drivers and hardware. This paper presents techniques that can be used to synchronise various software and hardware systems; it includes a case study of deploying a diverse application suite on a driving simulator.

11:30 - 12:30 - Lunch

Room B

09:00 - 12:30 - Legislative Challenges and Liability

09:00 - The development of EuroNCAP test procedures for autonomous emergency braking
Matthew Avery, research director, Thatcham Research, UK
Autonomous emergency braking systems are now widely fitted. Real-world insurance data from the UK and USA has indicated an overall 23% average reduction in crashes. Thatcham, as part of EuroNCAP, has developed test procedures for car-to-car and car-to-pedestrian crash scenarios based on in-depth crash studies. Test targets representing cars and pedestrians have been developed with accurate visual and radar properties. Car-to-car testing and rating now forms an integral part of the EuroNCAP star rating. Pedestrian testing will follow in 2016. AEB is a key step on the road towards autonomous driving.

09:30 - Self-driving vehicles and policy, legal and regulatory implications
Adeel Lari, director of innovative finance, University of Minnesota, USA
Whether you call them self-driving, driverless, automated or autonomous, these vehicles are on the move. Recent announcements by Google and other major auto makers indicate the potential for development in this area. Driverless cars are often discussed as disruptive technology with the ability to transform transportation infrastructure, expand access and deliver benefits to a variety of users. This report includes examination of the current status of this technology, the implications for road safety, capacity, travel behaviour and cost. It also considers the regulatory framework and policy challenges this technology may face. In particular, this research presents a US state perspective.
10:00 - Reality is not ideal: autonomy and driver assistance challenges
Alan Thomas, director - research & consultancy, CAVT Ltd, UK
Autonomous and advanced driver assistance systems can be good at averting collisions that have been coded into their algorithms, but human drivers can be good within their training and experience. It is the capacity to learn and intuitively interpret novel and ambiguous situations that may hinder ADAS and autonomous vehicles implementation. Some real-world examples of deviations from an idealised situational model will be presented to stimulate high levels of ADAS security. This is vital where infrastructure and traffic do not conform to standards, especially where the only alternative would be abrupt handover to a de-skilled and non-concentrating driver.

10:30 - Legalising autonomous vehicles: facilitating technological development
Stephen Hamilton, partner, Mills & Reeve LLP, UK
The current legal and regulatory regimes that apply to the control of vehicles on public highways is outdated and flawed when considered in relation to autonomous vehicles. What is needed is a new approach. Our presentation will explain the required changes to the legislative environment based on a separation of navigational control and critical event control. The presentation will also address responsibility and liability issues, in both testing and real-world usage of autonomous vehicles. By providing legal and liability standards for the industry to work within, legislative frameworks can facilitate, rather than impede, the development of this new technology.

11:00 - The impact of autonomous vehicles on future vehicle insurance
Matthew Avery, research director, Thatcham Research, UK
Vehicle manufacturers have already indicated their intention to commercially launch highly automated driving within three years. In order to identify liability, especially when control is handed back to the driver, system monitoring must be available to identify and price risk. As crash rates drop, risk rates are likely to change, with minor crashes being eliminated, and those that remain likely to be rare but catastrophic events. The modelling of future crashes is therefore required to fully understand future crash populations to enable test procedures to be developed that accurately reflect real-world risk.

11:30 - How to Build a Universal Standard For Test & Validation of Autonomous Vehicles
Daniel Craine, Engineer - durability test development, Millbrook Proving Ground, UK

Room A
13:15 - 17:30 - Real World Testing of Autonomous Vehicles

13:15 - Overview of Greenwich Automated Transport Environment – The GATEway project
Dr Nick Reed, principal human factors researcher, TRL, UK
The Greenwich Automated Transport Environment (GATEway project) is being developed by a consortium of partners led by TRL as part of a £10m competition led by Innovate UK (part of UK Government). The project will see three live tests of automated vehicles within Greenwich in London, and investigations of integration with traffic management systems, remote operation and driving simulators. In this presentation, the project objectives will be described and an overview of progress in all work packages of the project will be delivered.

13:45 - Experimentation centre for testing autonomous vehicles in adverse weather conditions
Dr Michèle Colomb, research director, Cerema, France
The French agency, Cerema, operates an experimentation centre known as the Fog and Rain R&D Platform for testing activities in adverse weather conditions. This infrastructure is 30m in length and can replicate varying fog and rain intensities and various water-particle sizes, controlled by weather sensors. This platform is unique in Europe and available for use by all companies and research institutes in order to evaluate the performance of smart sensors, driving assistance systems or autonomous vehicles. By testing the impact of reduced-visibility conditions on driving, Cerema could contribute to further specifications for testing procedures in inclement weather.

14:15 - AstaZero – test environment for future road safety
Håkan Andersson, director, testing/COO, AstaZero AB, Sweden
The AstaZero proving ground is constructed for the development, testing and certification of active safety systems, necessary if we are to limit future accident statistics. Entirely purpose built, the AstaZero facility opens new opportunities for industry, academia and others to test new technologies in every possible traffic situation and road type. The AstaZero facility consists of four test environments: city area, multi-lane road, high-speed area and rural road, where scenario-based tests can be carried out in a repeatable and structured manner.

14:45 - Testing of autonomous systems within whole-vehicle durability tests
Daryl Craine, Engineer - durability test development, Millbrook Proving Ground, UK
An insight into how Millbrook Proving Ground tests fully and semi-autonomous vehicle systems as part of a whole-vehicle durability test. The presentation will discuss the specific requirements of autonomous vehicle systems and their integration into full-life durability testing on the proving ground. It will also outline factors that should be considered by engineers who are developing test procedures or who are looking to test autonomous systems throughout the vehicle’s life.

Panel Discussion
11:30 - How To Build A Universal Standard For Test & Validation of Autonomous Vehicles

12:15 - 13:15 - Lunch

BOOK ONLINE NOW!
3-DAY PASS €1,050
2-DAY PASS €950

www.autonomousvehiclesymposium.com
13:15 - Human factors of automated driving
Frederik Diederichs, senior researcher, Fraunhofer IAO, Germany

Vehicle automation is changing the role of the driver dramatically. A cooperative interaction between the driver and the automated car needs to be carefully designed. The presentation is focused on the human factors relevant to designing such a co-working task, and presents state-of-the-art human-machine interface solutions from the market, research community and our own concept developments and empirical research at Fraunhofer IAO.

13:45 - Approaches for the HMI evaluation of Level 3 automation
Dr Lutz Lorenz, project manager HMI automated driving, BMW Research and Technology, Germany

Highly automated driving (Level 3 automation) allows the driver to temporarily turn away from the driving task, meaning he or she is allowed to deal with non-driving-related tasks and does not have to monitor the system. This leads to the challenge of getting the driver back into the loop if the automation reaches its system boundary. This presentation gives a general view of some driving simulator studies that analysed the takeover behaviour during highly automated driving.

14:15 - A framework to assess drivers’ interaction with automated vehicles
Arie Paul van den Beukel, assistant professor, University of Twente, Netherlands

Vehicles capable of autonomous driving are in need of new solutions for the driver’s interface and interaction. This is due to the additional driver’s role to supervise the system and to regain control if required. When developing such HMI solutions, developers are in need of appropriate and practicable assessment methods. This presentation therefore proposes a validated framework for assessment of driver interaction in terms of gained situation (or mode) awareness and performance in accident prevention. The framework includes relevant traffic scenarios and has been tested within driving simulator experiments.
Companies speaking at the inaugural 2015 conference include:

Ansible Motion Ltd • AstaZero AB • Berner & Mattner Systemtechnik GmbH • BMW Research and Technology • Brisa Innovation • CAVT Ltd • Cerema • CETECOM • Chemnitz University of Technology • CMORE Automotive GmbH • company_name • Concurrent Real-Time • Continental Teves AG & Co oHG • Cranfield University • CSA Group • Dr Steffan Datentechnik GmbH • dSPACE GmbH • Dynosens • Embedded Systems Technology • ESG Elektroniksystem- und Logistik-GmbH • ETAS GmbH • eXept Software AG • Exponent • Ford • Forum8 • Fraunhofer FKIE • Fraunhofer IAO • Fraunhofer Institute for Industrial Mathematics ITWM • Fraunhofer-Gesellschaft • Heicon • InOutCister, Lda • Institute of Ergonomics, Technische Universität München • Intempora • Israel Air Industry (IAI) • John Deere Technical Centre • Lange-Electronic GmbH • Millbrook Proving Ground • Mills & Reeve LLP • MIRA Ltd • mm1 • mm-lab GmbH • Moshon Data • MTS Systems Corporation • Plextek Consulting • Renault • Ricardo Inc • Robert Bosch GmbH • Rohde & Schwarz GmbH & Co KG • Spirent Communications • TASS International • Technische Universität Eindhoven • Thatcham Research • TRL • University of Minnesota • University of Twente • Vector Informatik • Vector Software • Verkehrsunfallforschung an der TU Dresden GmbH • ViGEM GmbH • Virtual Engineering Centre - University of Liverpool

BOOK NOW!

GO ONLINE NOW TO SECURE YOUR SEAT!

CONFERENCE RATES

<table>
<thead>
<tr>
<th>PASS TYPE</th>
<th>RATE</th>
<th>FULL RATE includes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-day FULL RATE</td>
<td>€1,050 +VAT</td>
<td>Conference proceedings, coffee breaks and lunch voucher</td>
</tr>
<tr>
<td>2-day FULL RATE</td>
<td>€950 +VAT</td>
<td></td>
</tr>
</tbody>
</table>

Autonomous Vehicle Test & Development Symposium 2015
Contact: Mike Robinson
UKIP Media & Events, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK
Tel: +44 1306 871209 • Fax: +44 1306 742526 • Email: mike.robinson@ukipme.com

www.autonomousvehiclesymposium.com