Autonomous Vehicle TEST & DEVELOPMENT Symposium Europe

Autonomous Vehicle INTERIOR DESIGN & TECHNOLOGY SYMPOSIUM EUROPE

Autonomous Vehicle SOFTWARE SYMPOSIUM

THE WORLD'S LEADING INTERNATIONAL CONFERENCE & EXHIBITION FOR DESIGN, DEVELOPMENT & TESTING OF AUTONOMOUS VEHICLES

5, 6, 7 JUNE 2018, MESSE STUTTGART, GERMANY

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Welcome

We are fast approaching the biggest autonomous vehicle event in Europe, taking place this June in Stuttgart. There will be 150+ expert speakers and over 500 delegates taking part across three conferences, and 80+ leading AV technology companies exhibiting. We also have **two exclusive workshops** from **Nvidia** and **Siemens** taking place on 7 June, both of which are included in the delegate pass fee. You can read more about the workshops on page 21.

This programme is divided into three distinct sections – one for each symposium. Please take time to read about each speaker and their presentation synopsis, to better understand what can be learned and to realise the great networking opportunities that can be gained by meeting the speakers.

For 2018, we have created a **'one pass, access all areas'** for delegates. This means that your pass will grant you access to the Autonomous Vehicle Test & Development Symposium, Autonomous Vehicle Interior Design & Technology Symposium, Autonomous Vehicle Software Symposium, the Nvidia and Siemens workshops, plus the Autonomous Vehicle Technology World Expo. Of course, your refreshments and lunch will be provided across all three days, and we invite you to attend the pre-event opening networking breakfast on Day 1 and the evening drinks reception on Wednesday 6 June.

We look forward to welcoming you to Stuttgart on 5, 6 and 7 June.

Best regards,
Andrew Boakes, conference director

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Autonomous Vehicle TEST & DEVELOPMENT Symposium Europe

5, 6, 7 JUNE 2018, MESSE STUTTGART, GERMANY

THE WORLD'S ONLY INTERNATIONAL CONFERENCE DEDICATED TO TESTING AND VALIDATION OF AUTONOMOUS VEHICLES AND SELF-DRIVING TECHNOLOGY

UPDATED PROGRAMME

DAY 1 TUESDAY 5 JUNE

09:00 - 12:45 - Room A - Keynote Presentations and Conference Opening

09:00 - Test development and execution system for autonomously performed scenarios
Mathias Klumpf, test and development engineer, Audi AG, Germany
To ensure highest quality and safety, complex testing of autonomous driving assistance is performed with every vehicle during SOP and later on at random. To include a maximum number of sensors and actors, autonomous parking procedures are chosen as test scenarios. The action of the vehicle is observed by a micro GPS system. The quality is automatically identified by a complex fuzzy-logic-based algorithm.

09:30 - Road attribute confidence values using HD maps
Michael Laur, senior technologist automated driving, Delphi, USA
The presentation will discuss a method of adding probabilistic confidence values to look-ahead road topology and world model attributes using HD maps.

10:00 - Insuring autonomous (test) driving
Andreas Bradt, project manager autonomous driving, Allianz Automotive, Germany
After more 130 years of automotive development, the autonomous car is almost here. Autonomous mobility will exist in many shapes, and insurance companies need to prepare for self-driving and the new risk factors. During the transition, the transfer of responsibility must be designed with safety as a high priority. Insurance products and processes will need to be adjusted to account for autonomous driving. Allianz has already gathered on-road experience by insuring autonomous vehicles globally. Not every accident can be prevented by an ADAS, and a standardised data storage system in automated vehicles is required.

10:30 - 11:15 - Break

11:15 - Validation of L4 urban automated driving
Dr Christian Krummel, VP, Robert Bosch GmbH, Germany
Validating a fully automated vehicle operating in urban scenarios is currently the ultimate challenge. Statistical approaches are neither feasible nor comprehensive. The talk will address current views of challenges and approaches in releasing self-driving vehicles.

More keynote speakers to follow – see the website for the latest updates

14:15 - 18:00 - Room A - Test, Verification & Validation

14:15 - Map-based validation of autonomous vehicles
Dr Henning Lategahn, CEO, Atlatec GmbH, Germany
Autonomous driving will hit the road in the near future. One of the obstacles that is still to be overcome is the validation of this technology. How can one prove that the vehicle senses the environment correctly? Two approaches are currently followed. One is real-world driving tests and the other is virtual testing in simulators. Both seem tempting. The first, however, suffers from the unavailability of accurate ground truth data, whereas the latter suffers from unrealistically simplified virtual worlds. We present an approach to acquire accurate 3D map data that can be used as ground truth and realistic 3D world models.

14:45 - Experiences gathered from the application of the ENABLE-S3 V&V architecture
Dr Andrea Leitner, research project manager ADAS, AVL List GmbH, Austria
This presentation aims to give an overview of first results of ENABLE-S3, a large European project with around 70 partners from industry and research. The project's goal is the provision of technology bricks (methods, tools and models) and a generic test architecture to enable more efficient testing of automated systems. Standardisation is a major enabler for modularisation and reuse. Therefore, the consortium evaluates and extends existing specifications such as OpenScenario and OpenSimulationInterface. The talk will highlight some first results showing advantages and limitations identified in selected demonstrators of the project.

15:15 - Autonomous drive controllers challenge validation and verification test data management
Alexander Noack, head of automotive electronics, b-plus GmbH, Germany
Centralised computing platforms for autonomous driving functions – the domain controllers – require a huge amount of input data. Multiple cognitive sensor sources in autonomous cars challenge the whole testing and validation scenario. Huge computing power processes gigabit data that forms the basis for decisions. Conventional ECU development methods such as prototyping platforms, vehicle loggers and simulation systems such as hardware in the loop are reaching technological limits. The presentation focuses on the changes in sensor architecture and the challenges of methodology for measurement data management in the domain controller environment.

15:45 - 16:30 - Break

16:30 - Maximising test coverage utilising high-fidelity vehicle record and playback techniques
Dragan Jadric, principal product manager, National Instruments, USA
As autonomous functionality in vehicles becomes more sophisticated, the test coverage required continues to expand. Traditional techniques such as hardware-in-the-loop testing provide an excellent foundation upon which to establish an autonomous vehicle test infrastructure, and track testing provides real-world sensor data required to thoroughly exercise the entire active safety system from sensor to software. However, system-level testing often requires sensor fidelity that is difficult to capture in simulation, and extensive track testing is incredibly expensive. By combining real-world logging with lab-based HIL simulation, you can generate the highest-fidelity data streams and play them back in a variety of controlled scenarios to maximise test coverage.

17:00 - Unified system of tools for ADAS
Dr Florian Baumann, technical director, Adasens Automotive GmbH, Germany
We are proposing a unified system of tools to efficiently test and validate computer vision algorithms. This includes the categorisation of different self-developed tools for pre-development, development and post-development stages. The pre-development stage consists of recording and planning tools. The development stage consists of tools to visualise output of cameras, lidar or radar. The post-development stage is to test KPIs such as ROC curves, false positives, etc. This talk will inspire people to develop such tools internally. All tools are running via a web front-end, and demos will be shown during the presentation.

17:30 - Systems approach to creating 'interesting' test scenarios for autonomous vehicles
Siddartha Khastgir, PhD researcher, WMG, University of Warwick, UK
To prove that automated driving systems are safer than human drivers, it is suggested that they will need to be driven for over 11 billion miles. However, rather than number of miles it is the quality of miles that is important. To find the 'interesting scenarios', a novel systems engineering method – an extension to the STPA method – has been developed and applied to low-speed automated driving systems (pods). One of the features of the proposed method is the ability to create test scenarios and pass criteria.

14:15 - 18:00 - Room B - Vision – Sensors, Lidar & Mapping Technology

14:15 - Maps as a sensor for the autonomous car
Mike Tzamaloukas, vice president, BU autonomous drive/ADAS and CoC navigation, Harman, Germany
With the advent of the autonomous car, modelling the environment has been a challenge and an opportunity of unprecedented scale. Mike Tzamaloukas, vice president, BU Autonomous Drive, ADAS and Navigation, Harman will present a novel framework that ensures that every connected car on the road has the ability to benefit from validated, crowdsourced information. In this presentation, Mike will address topics spanning efficient multi-sensor data collection, normalisation and machine learning cross-validation, spatio-temporal confidence estimation, data sharing and customer privacy. He will also offer insights on how this technology can help reduce production quality costs and accelerate go-to-market timelines for OEMs, fleet operators and transportation city planners.

14:45 - NDS and OADF map standards for successful AV deployment
Dr Volker Sasse, VP Navinfo / chairman NDS and OADF, Navinfo & NDS, Germany
This presentation will address NDS and OADF map standards, which are key for successful deployment of autonomous vehicles. History shows that the map was always of high importance. However, AVs require the support of better maps. Therefore, the whole world will need be mapped extremely precisely. For example; Japan already collected all freeway maps for autonomous driving at Olympia 2020. But AVs require worldwide standard maps and more cooperation because each car acts on map data collection; other updates are too slow. Up and down streams will fill the air with map data. Within OADF, several standards like NDS, ADASIS, SENSORIS and TISA will cooperate.

15:15 - Enabling autonomous vehicles in inclement weather
Phil Magney, founder and principal, VSI Labs, USA
Enabling automated driving in inclement weather is challenging because sensor performance is compromised. For example, a light snowfall that covers lane markings would render most methods of lane keeping inoperable. However, there are new methods for localisation that heighten the performance of automated vehicles. In this presentation we will share our experience using precision map data to improve the AV performance in poor weather. By using different methods of localisation against the precision map, VSI will discuss how it uses HD maps to improve the performance and safety of automated vehicles, even when lane markings are covered or absent.

15:45 - 16:30 - Break

16:30 - Integration of solid-state lidar in vehicles: best practices for superior object detection
Filip Geuens, CEO, XenomatiX, Belgium
Technology choices for automotive lidar must be based on how and where the lidar units can be integrated in vehicles. This integration impacts the lidar technology as well as the vehicle itself. As the need for reliable solid state lidar systems continues to grow, considerations about sensor positioning and ways to achieve reliable detection are gaining automotive attention. This presentation will report on some of the outcomes from the research cooperation with Tier 1 partners for specific and integrated lidar positioning. The use of lidar as a reference or complementary system for camera-based or sensor-fused detection will also be addressed with regard to the lidar vs. camera positioning.

17:00 - Determining precise boresight alignment of a lidar for autonomous driving
Richard Sands, application engineer, Oxford Technical Solutions Ltd, UK
This presentation covers a recent case study that addresses the challenges faced determining precise alignment of lidars in an inertial navigation system frame. We have developed a reliable calibration method to remove systematic errors caused by mechanical misalignment. We will share techniques used to validate the calibration result, along with specific findings that will help to improve confidence in open-road sensor testing and validation projects.

17:30 - Challenges of multi-sensor and fusion ECU measurement for ADAS Level 3-5
Alfred Kless, business development manager, Vector Informatik, Germany
The presentation shows the challenges and solutions for a complete ADAS logging approach: multichannel vehicle bus logging – CAN-FD, FlexRay, LIN, Auto-Ethernet; radar measurement technology for raw data as well as object data; high-end fusion ECU measurement with multi uC + uP architecture based on Autosar and Autosar adaptive operating systems; multiple vehicle and reference camera measurement; other sensors such as laser scanner, ultrasonic and GPS. The unique solution covers two use cases: 'Engineer Mode' with full graphical object overlay display, and 'Taxi Driver mode'.

14:15 - 18:30 - Room C - Testing Autonomous Vehicles in Real-Life Environments

14:15 - Complete approach for testing automated vehicles on a testing ground
Dr Houssem Abdellatif, global head autonomous driving and ADAS, TÜV SÜD, Germany
The physical testing of highly automated vehicles is a very challenging task. Highly accurate and repeatable replay of complex manoeuvres must be achieved on the test ground to judge the ability of autonomous vehicles to cope with different situations. For this purpose, we present a complete technical setup that has been developed by TÜV SÜD and its partners. Soft static targets, remotely controlled traffic simulation vehicles, a vehicle control system, highly sophisticated sensors and a monitoring system work together precisely. Technical details and demonstrations are provided in this talk.

14:45 - Using the StreetWise scenario base for virtual safety assessment
Sytze Kalisvaart, project manager integrated vehicle safety, TNO, Netherlands
For virtual safety assessment of automated driving vehicles, a set of test scenarios is needed with real-world validity. The StreetWise scenario database is based on real-world driving data. Parameterised observed variants of the scenarios are stored. When using the database for virtual testing, the test engineer will have to select a relevant set of scenarios for the system under test. A data-driven approach for determining the relevance of the scenario is proposed. Also, the interface 'scenario database – simulator tool' and relationship to key performance indicators is presented.

15:15 - London's Smart Mobility Living Lab
Iwan Parry, head of connected and autonomous vehicles, TRL, UK
This presentation will provide a review of London's Smart Mobility Living Lab, part of the UK Government's £100m investment in creating an integrated CAV testbed ecosystem for on- and off-road testing. The Smart Mobility Living Lab will build on established and ongoing CAV projects in London, including GATEway and MOVE_UK, and provide infrastructure to support real-world testing, development and evaluation of CAVs and CAV mobility solutions together with new ITS and communications technologies.

15:45 - 16:30 - Break

16:30 - Importance of real-life deployment of autonomous vehicles in mobility services
Raphael Gindrat, CEO, BestMile, Switzerland
The democratisation of autonomous vehicles will be directly impacted by the quality of the resulting mobility services and their integration in the current transportation infrastructure. In June 2016, Switzerland was one of the first countries to set up a service of electric autonomous shuttles circulating through a city centre in pedestrian areas and on open roads. Today, deployments of autonomous shuttles are blossoming worldwide, and are crucial to address challenges inherent in public acceptance and the integration of autonomous vehicles in urban areas. The presentation will offer a deep dive into existing autonomous vehicle deployments around the world.

17:00 - Exploring automated bus lines and cooperative driving
Dr Arie P van den Beukel, assistant professor, University of Twente, Netherlands
Reliable automation within complex traffic situations, especially in cities, is challenging. For city transport, municipalities face high costs of bus lines. These seem inefficient because buses are used intensively during rush-hours but at other times by only a handful of people. Nonetheless, municipalities need to offer basic transport facilities. Because the main expense is labour costs, some municipalities are considering automated buses within their towns. To optimise availability, costs and reliable operation, a system design is being explored with small bus units that individually drive autonomously in dedicated lanes and drive cooperatively with a human lead driver in town.

17:30 Panel Discussion – Get the maximum from real-world testing

High-quality data generation, public perception, repeatable real-world scenarios – we discuss how to get the most from your real-world testing programmes.

Dr Houssem Abdellatif, global head autonomous driving and ADAS, TÜV SÜD, Germany

Sytze Kalisvaart, project manager integrated vehicle safety, TNO, Netherlands

Raphael Gindrat, CEO, BestMile, Switzerland

DAY 2 WEDNESDAY 6 JUNE

09:00 - 12:45 - Room A - Validation in the Virtual Domain

09:00 - Training and validating automated driving applications using physics-based sensor simulation
Robin van der Made, product manager software and services, TASS International (a Siemens Company), Netherlands
One of the latest needs in the area of automated driving is the generation of sensor data as input for deep neural networks for the purpose of training automated driving applications. The PreScan simulation platform can be used to generate virtual sensor data of all sensor technologies relevant to automated driving, such as camera, radar, lidar, ultrasound and DSRC. In this presentation we also present the added value of injecting synthetic sensor data directly into platforms such as the Mentor Graphics DRS360 and Nvidia Drive PX2 for virtual validation of automated driving applications by means of hardware-in-the-loop (HiL) simulation.

09:30 - Virtual twin of the London CAV testbed
Jon Horsley, programme director, Digital Engineering & Test Centre, UK
The UK Government has recently funded a coordinated set of physical CAV test facilities between London and Birmingham to provide CAV technology developers from across the world with the facilities to develop and test the essential underlying technology and actual vehicles on public roads and safe off-highway environments. Alongside the physical, we are building the virtual testing environments and bringing innovative new technology from gaming, AI, etc. into automotive testing for the first time to achieve the required test quality at much reduced time and cost. This paper will outline this exciting coordinated activity and examine the digital London space.

10:00 - Object detection and classification based on virtually trained neural networks
Ronnie Dessort, simulation consultant, TESIS DYNAware GmbH, Germany
In autonomously driven vehicles, object detection and fusion of sensor information enables the vehicle to perceive its environment and decide for certain driving manoeuvres. The virtual development of such systems allows the comfortable definition and reproducibility of a large number of traffic scenarios. In this contribution, a publicly available state-of-the-art algorithm based on deep learning is trained and tested in a virtual 3D world. Special focus is put on variation of different harsh environmental conditions such as rain or soiled traffic signs. The results show that the presented development method can be used as an appropriate complement to common development.

10:30 - 11:15 - Break

11:15 - New sensor simulation concept for virtual test drives
Caius Cioran, application engineer, dSPACE GmbH, Germany
The market introduction of autonomous vehicles is on the horizon. A crucial element of these systems is the reliable environmental perception by means of camera, radar and lidar sensors. Functions for autonomous driving have to be test-driven hundreds of millions of kilometres. This is possible using virtual test drives and SIL/HIL simulation only. In this context, appropriate sensor models and integration options of sensor ECUs with HIL test benches are the key. This presentation outlines a new sensor simulation concept and a generic interface unit to insert raw data behind sensor front-ends. A unique radar sensor model is introduced.

11:45 - Traffic simulation for connected and autonomous vehicle technology testing
Dr Alex Gerodimos, executive director, Aimsun, USA
Connected and autonomous vehicles (CV/AV) have the potential to tackle challenging problems related to safety and efficiency. Accidents, congestion and pollution in urban areas could be substantially reduced if these technologies were adopted on a large scale. One of the main challenges for transport agencies and technology developers alike is to find ways to evaluate the performance and impact of such technologies before they are deployed. Simulation provides a comprehensive, repeatable, cost-effective and near-limitlessly scalable testing environment. As such, simulation provides an excellent digital complement to field testing for regression and pre-deployment scenarios.

12:45 - 14:15 - Lunch

12:15 Panel Discussion – Harnessing the power of simulation

Simulation is fundamental to validating autonomous driving application. In this discussion, we will reach further into virtual environment, SIL/HIL and virtual data creation.

Robin van der Made, product manager software and services, TASS International (a Siemens Company), Netherlands

Jon Horsley, programme director, Digital Engineering & Test Centre, UK

Caius Cioran, application engineer, dSPACE GmbH, Germany

14:15 - 18:00 - Room A - Robust Test, Verification & Validation Methodology

14:15 - Processes, tools and philosophy to develop an autonomous electric truck
Joachim Fritzson, CEO, Zuragon, Sweden
As a new way of thinking about road transport, Einride was facing a lot of challenges. New powertrain technologies had to be merged with autonomous driving logic and new sensor technologies. This required the freedom to choose processes and tools without having to compromise with legacy development, but at the same time facing the pain of starting to work from a blank sheet. This presentation discusses the learning curve up to now, and how ViCANdo has helped in accelerating the process and balance risk, and cut development and validation time by being multi-platform capable.

14:45 - The structure of test specifications of highly automated driving functions
Dr Hardi Hungar, team leader verification and validation methods, German Aerospace Center (DLR), Germany
Currently, scenarios are considered as main elements in test specifications of highly automated driving functions. A scenario captures a large number of concrete test cases in a formal way. It must permit these test cases to be generated automatically. And the collection of scenarios must cover all behaviour that needs to be tested. The scenario language needs sophisticated constructs to cover the complex, reactive patterns of road traffic. And the test specification must allow overlapping of cases to be systematically coped with. The presentation proposes a conceptual solution to these problems of formalisation and evaluation.

15:15 - Challenges for testing with platform robots at high speeds (+100km/h)
Markus Schmidl, COO, DSD Testing, Austria
Test speed demands for active safety system testing are continuously rising. Current requests from the automotive industry are up to 130km/h. UFO currently reaches speeds of 100km/h as a first platform test. The presentation shows the challenges for the test equipment and the proving ground of testing at these high speeds.

15:45 - 16:30 - Break

16:30 - Verification techniques for safety and security in autonomous vehicle software
Dr Mike Bartley, CEO, Test and Verification Solutions Ltd, UK
The Innovate UK-funded CAPRI project brings together an experienced consortium of partners from industry, academia and local authorities, working together to deliver a complete end-to-end POD mobility service. The consortium aims to collate sufficient evidence from the deployment trials and simulation testing to support PODs becoming a recognised vehicle classification for use on public roads. This presentation will discuss: verifying and validating the safety and security of the next generation of PODs for the on- and off-road environments, and collating sufficient evidence to support PODs as a new vehicle classification.

17:00 - Applying proven methods for quantifying test results and test coverage
Rainer Straschill, ADAS/AD strategist, FEV Europe GmbH, Germany
The presentation will show that questions of test coverage for self-learning systems can be solved: any self-learning system in our scope, including those with non-deterministic portions, can be identically transformed so that the aspects of self-learning and non-determinism can be considered identically to the problem of the unknown use case population. Next, the presentation will explain how established and proven approaches from different domains (experimental physics, mathematical statistics, data analysis) can be applied to achieve a measure for test coverage in the situation of populations where only basic knowledge about their properties exists.

17:30 - Testing the connected vehicle
Rosario Trapero, manager Connected Car Competence Center, Dekra, Spain
The connected vehicle landscape is complex, with different communication protocols and standards involved. Successfully implementing and verifying the variety of safety applications in the connected car requires testing at several different levels, including the physical layer, the protocols and the algorithmic functionality of the applications. In this paper, a comprehensive approach for testing all these different layers is presented, covering laboratory and in-the-field testing procedures.

09:00 - 12:45 - Room B - Open-Road & Real-World Testing

09:00 - Testing autonomous vehicles in harsh winter conditions – key findings
Harri Santamala, CEO, Sensible 4 Ltd, Finland
Sensible 4, a startup focusing on automation technologies under harsh conditions and varying environments, will take its self-driving vehicle to northern Lapland for testing during the winter of 2017-2018 as part of the Aurora Arctic Challenge project. Perception, remote control and multi-sensor redundancy and solutions will be studied in open-road tests. The presentation will describe field-test arrangements, technology, key findings and results obtained.

09:30 - Real-life testing under experimental clauses – recent regulatory developments
Dr Alexander Duisberg, partner, Bird & Bird LLP, Germany
Sandbox testing under real-life conditions only works if the regulatory framework strikes a good balance between incentivising innovation and warranting the safety of others. Federal government is aware of the challenges to enable quick and efficient administrative processes, which may touch on all sorts of regulations. 'Experimental clauses' and related approval processes are making their way into the framework. The presentation analyses examples around autonomous drive and other areas of testing from a legal and regulatory perspective, and how government is pushing ahead to enable faster and better administrative processes to facilitate such 'real laboratories'.

10:00 - The UK's CAV testing ecosystem
Michael Talbot, head of industrial strategy, CCAV (UK Government's Centre for Connected and Autonomous Vehicles), UK
CCAV presented an overview of the UK's new CAV testing ecosystem programme at the AV Symposium in 2017. Since then we've announced the winners of the first £51m competition (matched by industry to £102m) and launched MERIDIAN, the 'CAV hub' that will coordinate the UK's capabilities and promote them internationally.

10:30 - 11:15 - Break

11:15 - Real-world driving scenario identification for AV functional safety
Gildas Thiolon, engineer data scientist, Vedecom, France
Knowledge of the real-world driving environment involving manually driven cars is fundamental, allowing detailed identification of safety issues encountered by autonomous cars in similar complex situations. The MOOVE project has been created to study this problem. This presentation: explains the context and the developed methodology applied to the collected data; presents the data modelling applied to build the database; identifies the role of crucial variables interfering in the extracted real-world driving scenarios. Thus, improved robustness will be achieved for the autonomous vehicle architectures and systems being developed at the Vedecom Institute.

11:45 - Controlled field testing of automated and connected driving in urban environments
Rico Auerswald, research fellow, Fraunhofer Institute for Transportation and Infrastructure Systems IVI, Germany
Current test and validation procedures for automated driving functions use field tests on public roads primarily to identify unknown critical scenarios. These scenarios are then validated in simulations or on test sites. The complex traffic environments required to validate automated driving functions in urban traffic may not be investigated with sufficient detail outside of field tests. Therefore, we present an approach that increases the reliability of field tests by generating scenarios considering real urban roads with public traffic, focused resource coordination for the test procedure and cooperation with connection infrastructure in the Digital Testbed Dresden.

12:15 - Regulatory testing of autonomous vehicles for trials in residential areas
Niels de Boer, programme director, CETRAN, Nanyang Technological University, Singapore
Singapore is embarking on a roadmap towards deployment of autonomous vehicles as a part of the transport system in residential areas. To extend the trial of AVs from the existing testbed area to residential areas, a 'milestone 2' test needs to be passed, after which the licence to test AVs will be amended and the permission to test in defined residential areas will be added. This presentation will give an overview of the test requirements, the test definition and technical assessment methodologies, and the work to improve and extend the testing based on feedback from trials of autonomous vehicles in residential areas.

12:45 - 14:15 - Lunch

14:15 - 18:00 - Room B - Using Simulation to Advance System Design & Validation

14:15 - Real challenges for simulation in verification and validation of AVs
Dr Roberto Ponticelli, chief engineer - intelligent mobility, Horiba MIRA, UK
The ever-increasing use of virtual design, verification and validation (vDV&V) tools is supported by a sound base of successful case studies across most engineering and scientific areas (e.g. medicine, aerospace and automotive). Nevertheless, there exists a risk of a false sense of safety when the tools used on vDV&V of safety-related systems are not well understood, particularly in highly complex systems like autonomous vehicles. This talk will address how the modelling methods, physical data and correlation, design and test traceability and coverage, operational boundaries, dynamic environments, hardware in the loop (HIL), scenarios annotation and generation, and other key parameters shape the challenge for AV vDV&V.

14:45 - Enabling the massive simulation that autonomous driving validation requires
Enguerrand Prioux, ADAS/AV product line manager, Siemens, France
Proper SAE Level 4-5 vehicle validation will require – at the least – millions of scenarios to be checked. For project timing and testing conditions reasons, this will be entirely feasible only through simulation. To validate sensor technology and design, computer vision and sensor fusion, the decisional and executive driving agent, and actuation, most companies will have to couple several simulation models (AI, controls, world, sensors, vehicle physics) and perform a massive simulation activity to sufficiently sample the scenarios space. In this presentation we will communicate Siemens' progress in this area through a concrete simulation case.

15:15 - Key simulation features for autonomous vehicle validation
Thomas Nguyen, R&D projects and AD/ADAS product manager, AV Simulation, France
Recent projects in France and Germany show that simulation will play a key role in demonstrating the safety of autonomous vehicle systems. The key features for these purposes are scenario and sensor models. At AV Simulation, a new joint venture between Oktal and Renault, we have developed a versatile simulation engine dedicated to virtual evaluation and validation of automotive systems. In this presentation, we will present key integrated features: a powerful generation engine that enables a complete representative set of scenarios, based on templates, and a complete tool chain for sensor simulation, including phenomenological, statistical and full-physical modelling.

15:45 - 16:30 - Break

16:30 - Purpose-driven scenario generation
Dr Andreas Höfer, product manager simulation software, IPG Automotive GmbH, Germany
ADAS have undergone a rapid evolution. Formerly integrated as standalone components, modern ADAS are networked with each other, which causes new challenges for development and testing. This calls for new testing techniques, such as scenario-based simulation. There are three basic ways to create scenarios: outlining on the drawing board and manual creation with a scenario editor; generation based on map data with optional enhancement in a scenario editor; generation based on real-world measurements with optional enhancement in a scenario editor. Each approach has its own strengths and weaknesses, which are described in this presentation.

17:00 - Massively parallel simulation for testing and validating autonomous vehicles
Christopher Hoyle, technical director, rFpro, UK
Over the last two years we have developed a scalable, fast, open simulation environment for autonomous vehicle testing and validation. Multiple ego vehicles may share the same simulated real-world environment, each with multiple sensor model feeds. The entire environment may run offline, for automated regression testing, or may run real-time, which also allows multiple human drivers to join the simulation, from driving simulators, adding stochastic, unpredictable, error-prone behaviour, i.e. real human behaviour, into the simulation. The same simulation environment may be shared by multiple OEMs or Tier 1s to evaluate how their autonomous vehicles behave when they interact.

17:30 - Virtual testing by coupling system simulation with SUMO traffic flow simulation
Dr Jakob Kaths, product manager, TESIS DYNAware GmbH, Germany
Increasing automation in the automotive sector will lead to a stronger interaction of individual vehicles with surrounding motorised and non-motorised traffic and with traffic infrastructure. This creates new requirements for virtual development and testing that can be met by integrating automotive and traffic engineering simulation tools. To this aim, an approach is presented to seamlessly couple high-fidelity models based on Matlab Simulink and the microscopic traffic flow simulation SUMO. This is achieved by establishing a co-simulation setup between the two tools while using common map information based on the OpenDRIVE road description format and including driving dynamics, controllers and in-vehicle sensors such as camera, radar, lidar and ultrasonic.

09:00 - 18:00 - Room C - Connected Vehicle & Infrastructure Technology

09:00 - Intelligent traffic lights: from testing to deployment NEW
Jeannet van Arum, director smart mobility, Province Noord-Holland, Netherlands
Harm Jan Mostert, senior advisor smart mobility, Province Noord-Holland, Netherlands
The province of Noord-Holland is working on V2X communication. By putting in place intelligent traffic lights, which are able to communicate either through wi-fi P or 3G/4G, use cases can be carried out. Industry and government identified 'Day One' C-ITS use cases as the first promising ones for deployment. A couple of these Day One use cases relate directly to traffic lights. In the last two years the province of Noord-Holland (regional road authority in the Netherlands) combined pilots and deployments for these use cases. This presentation will focus on the lessons learned.

09:30 - Infrastructure for connected and automated driving in Hungary
Adam Nagy, traffic engineer, Hungarian Public Road, Hungary
Future mobility requires more and more online information even from the road. The Hungarian Public Road company is committed to supporting this development. C-ITS deployment started in 2015 in Hungary to demonstrate the use of C-ITS to exchange data through wireless communication technologies between vehicles and infrastructure (V2I). Road safety improvement, especially work zone safety, was the key issue, but the upgrading of services is ongoing. A 136km-long stretch of motorway M1 has been covered, and an extension is planned in 2018 with urban-interurban use cases. The company is also participating in the deployment phase of an automated proving ground and test zone in Zalaegerszeg.

10:00 - A high-integrity, automotive-grade antenna system optimised for V2X DSRC communications
Dr Oliver Leisten, technical director, Helix Technologies Ltd, UK
The safety-critical role of V2X DSRC in driver-assist and autonomous vehicle systems requires particular attention to 'real-world' channel/propagation challenges which to-date have not been successfully addressed by incumbent antenna technologies. Helix Technologies is developing an antenna based on dielectric-loaded, multi-filar helix antenna technology that is optimised for use in the V2X DSRC IEEE 802.11p environment and employs the use of a diversity system architecture. The V2X DSRC antenna to be developed by Helix Technologies will employ two ceramic-based, compact, dielectric-loaded, multi-filar antenna elements co-located so as to provide optimum antenna diversity, promote link reliability and eliminate coverage nulls.

10:30 - 11:15 - Break

11:15 - Aurora Borealis Intelligent Corridor for snowtonomous driving and CAD testing
Reija Viinanen, director Aurora collaboration, Finnish Transport Agency, Finland
Aurora Borealis Intelligent Corridor is a digital cross-border corridor on E8 from Norway to Finland. The main objective is to enable C-ITS and CAD testing in arctic conditions. The road has been instrumented with supporting infrastructure to promote car makers' CAD trials on public roads. E8 provides an opportunity to test cross-border ITS solutions and snowtonomous driving in arctic conditions, and research what kinds of infrastructure and roads will be needed in the future in terms of automated vehicles.

11:45 - Solutions for V2X test and validation for the connected car
Axel Meinen, technical sales manager, S.E.A. Datentechnik GmbH, Germany
This presentation will focus on necessary tools for test and validation of upcoming mobile communication like 802.11p or cellularV2X (LTE-V) for connected autonomous driving vehicles. S.E.A. has developed a test platform to test and validate the technologies and the corresponding hardware like ECUs and onboard units with respect to RF communication and compliance, protocol analysis and validation, as well as complex scenario generation including GNSS simulation for open-loop or closed-loop HIL tests. A brief overview of the different test aspects will be given, and a way to analyse and visualise the V2X test data will be demonstrated.

12:15 - Panel Discussion – The role of a transport authority in developing and implementing V2X technology

Many believe that true L5 AVs cannot be achieved without C-ITS. Here we will discuss the role of transport authorities in creating a robust V2X network.

Jeannet van Arum, director smart mobility, Province Noord-Holland, Netherlands

Harm Jan Mostert, senior advisor smart mobility, Province Noord-Holland, Netherlands

Adam Nagy, traffic engineer, Hungarian Public Road, Hungary

Reija Viinanen, director Aurora collaboration, Finnish Transport Agency, Finland

12:45 - 14:15 - Lunch

14:15 - Leveraging V2I communications to enable fully autonomous operations
Mike Haldane, vice president of global marketing, Global Traffic Technologies, USA
For nearly 50 years, Global Traffic Technologies' traffic signal priority control technology has been connecting vehicles to infrastructure. This technology has evolved from IR to GPS-enabled radio and cellular-based communications. The V2I communication infrastructure that enables driver-assisted priority control can be extrapolated to autonomous vehicles as technologies advance. GTT's latest application in New York City leverages existing connectivity on buses and at intersections to create a centralised transit signal priority (TSP) solution. This centralised solution demonstrates how cities and companies can use connected hardware to create a reliable network that is capable of supporting autonomous vehicles.

14:45 - Supporting vulnerable road users in connected and automated driving landscapes NEW
Dr Fatih Özel, project manager and consultant, Oecon Products and Services GmbH, Germany
Connected and automated vehicles (CAVs) are the subject of extensive research nowadays owing to their potential to improve safety. The Federal Ministry of Transport and Digital Infrastructure in Germany has funded the Digitaler Knoten 4.0 (Digital Intersections) project, which aims to develop and test CAV technologies for traffic intersections. As part of the project, a smartphone app is developed for integrating cyclists and pedestrians (vulnerable road users or VRUs) into the overall cooperative CAV system. This paper presents the existing technological approaches for integrating VRUs in cooperative CAV systems, our adopted approach as well as future development and implementation steps.

15:15 - Active pedestrian safety testing in CARISSMA
Dr Igor Doric, senior researcher and deputy scientific and technical manager, CARISSMA, Germany
The presentation will discuss the results of the pedestrian safety research projects TARGETS

and VISYTE. The projects ran from October 2013 to October 2015, and from November 2015 to January 2018 respectively, and were supported by the Federal Ministry of Economic Affairs and Energy, on the basis of a decision by the German Bundestag. Furthermore, the presentation will provide details about the CARISSMA research and test centre, including the CARISSMA rain simulation.

15:45 - 16:30 - Break

16:30 - Pedestrian in the Loop

Michael Hartmann, research engineer, Virtual Vehicle Research Center, Austria

A large number of testing procedures have been developed to ensure vehicle safety in common and extreme driving situations. However, these conventional testing procedures are insufficient for testing autonomous vehicles. They have to handle unexpected scenarios with the same risk a human driver would take – or less risk. Currently, safety-related systems are not adequately tested, e.g. in collision avoidance scenarios with pedestrians. Examples are the change of pedestrian behaviour caused by interaction, environmental influences and personal aspects, which cannot be tested in real environments. It is proposed to use a test environment with flying drones. Name: Pedestrian in the Loop.

17:00 - Panel Discussion – How do we develop, test and verify AVs to protect vulnerable road users?

Vulnerable road users and pedestrians create unique challenges for AV test programmes. In this discussion, we will evaluate current and future testing methods for VRUs and pedestrians.

Dr Fatih Özel, project manager and consultant, Oecon Products and Services GmbH, Germany

Dr Igor Doric, senior researcher and deputy scientific and technical manager, CARISSMA, Germany

Michael Hartmann, research engineer, Virtual Vehicle Research Center, Austria

DAY 3 THURSDAY 7 JUNE

09:00 - 10:30 - Room A - Using a Test Facility to Advance Testing Programmes

09:00 - Introducing the UK's controlled urban testbed for connected and autonomous

Peter Stoker, chief engineer - vehicle, Millbrook Proving Ground Ltd, UK

The critical need for a semi-controlled but realistic urban test environment for CAVs that seamlessly connects with open-road urban environments, raises unique challenges. Millbrook, in collaboration with the United Kingdom Atomic Energy Authority's RACE, is working to address these challenges. Based on a step change enhancement to existing roads and test capability, the facility will revolutionise preparation and validation of CAVs, services and technologies for public road deployment. It will offer open access to users – including developers of software, sensors, roadside units, telecommunications (5G) and cybersecurity systems – to explore public and industry impacts and accelerate the development of CAV technologies.

09:30 - Proving Ground Zala – a unique test environment for future mobility

Zoltán Hamar, technical director, Automotive Proving Ground Zala Ltd, Hungary

The objective of the project is to establish an automotive testing site for the automotive and communication industry, which would be built on the domestic R&D capacity of the sector and on European R&D capacities equally. In line with current and future automotive trends, when establishing the testing site we place special emphasis on the testing needs of autonomous vehicle systems and related environmental conditions. Proving Ground Zala is a unique test site where the fusion of classic dynamic test elements and test elements of future technologies are realised on a 260ha area.

10:00 - Autonomous highway driving in undetermined weather conditions

Dr Sergey Shadrin, scientific advisor, BaseTrack, Russia

Technology provides autonomous driving within a road lane without visual recognition of the road marking, while reaching speeds up to 130km/h in undetermined weather conditions (rain, snow, etc.), which is achieved by receiving high-precision navigational data. The composition of the technical solution includes in-vehicle automation kit, hybrid navigation system, safety subsystem of risk assessment. The proposed approach provides highway autonomous driving and supports lane-keeping assistance systems in cases of road marking visual recognition failures. Practical issues will be presented.

10:30 - 11:15 - Break

"I have attended the Autonomous Vehicle Test & Development Symposium on multiple occasions and it never disappoints. The speakers are always well versed in the latest industry trends and best practices, and being able to network with others in the industry who are developing autonomous vehicle technologies is incredibly beneficial. This event has its finger on the pulse of the autonomous vehicle development community, and it provides me with insight that I can use every day."

Nicholas Keel, group manager – DAQ and control product management, National Instruments

11:15 - 16:15 - Room A - Using Simulation for Test Scenario Validation

11:15 - Digital simulation is key to autonomous driving safety

Jean-Paul Roux, senior vice president, EU operations, Exa Corporation, UK

Digital anti-soiling simulation work is particularly significant in the upcoming world of sensor-controlled fully autonomous vehicles. We explain how PowerFLOW software incorporates dirt, dust and water into simulation – with the real-world accuracy that can only be achieved using a transient solver. We explain how the particle-handling capability of the software enables automotive and truck manufacturers to deliver a safer and much-improved driving experience through better control of soil and water accumulation on autonomous driving sensors.

11:45 - Dynamic ground truth measurement for simulation and post-processing

Steffen Metzner, technology scout ADAS, simulation and control, AVL List GmbH, Austria

For development of ADAS and AD functionalities, use of environment simulation tools is a well-accepted methodology. Most expensive and time consuming is the manual definition and design of complex scenarios as input to the experiments. The DGT (Dynamic Ground Truth) research project investigates methodologies and measurement systems for the capturing of dynamic objects surrounding moving test vehicles without the need for invasive changes (e.g. to mount sensors). The recorded data should be usable for onboard processing (enabling direct evaluation and comparison with the environment model of the vehicle) and offline post-processing for more accurate and detailed data analysis.

12:15 - Scenario-based performance assessment framework for automated vehicles

Erwin de Gelder, scientist, TNO, Netherlands

In view of recent developments in autonomous vehicles (AVs), the need arises for an efficient AV road-approval procedure. To this end, a safety assessment framework that employs virtual assessment of traffic scenarios is proposed. This framework consists of four components: data acquisition, scenario extraction and parameterisation, virtual safety validation and physical safety validation. Due to the simulation-orientated nature of this framework, quantitative and statistically relevant measures for safety-related AV performance are obtained while minimising the number of physical tests, thus realising an efficient procedure. The assessment framework is currently being developed in Singapore to accelerate AV deployment.

12:45 - 14:15 - Lunch

14:15 - Realistic human behaviour in simulation: the problem no-one has cracked

NEW

Kirsty Lloyd-Jukes, managing director, Morpheus Labs, UK

We all know simulations will be critical for AV testing. But there's one problem that no-one's cracked yet: how to accurately represent human behaviour (driver, cyclist, pedestrian) in a simulator. Traditional methods like swarm don't provide sufficient fidelity to really put an autonomous car through its paces. After all, if humans always behaved in a logical and rule-abiding way, human error wouldn't be responsible for 95% of accidents. This presentation explores an alternative approach: how a state-of-the-art machine learning technology called 'learning from demonstration', normally deployed in the field of social robotics, can be applied to cracking this exciting problem.

14:45 - High-performance driver-in-the-loop simulators for autonomous vehicles

Dr Andras Kemeny, expert leader, Simulation & VR, Renault, France

For safe autonomous vehicle products for all, validation on billions of kilometres is needed, thus using both massive and driver-in-the-loop simulation, with a large number of driving scenarios. One of the main critical scenarios is the handover between manual and autonomous mode in different traffic situations. The new high-performance ROADS dynamic driving simulator, commissioned to AVS, will help Renault test these cases in the most efficient and realistic way and design the best experience for the final client as well as providing help for general driver acceptance and public approval.

15:15 - Decision-making evaluation by oracle vision

Dr Rémi Régnier, researcher in evaluation of data processing systems, LNE, France

The SVA Project aims to meet the challenge posed by the complexity of demonstrating the safety of autonomous vehicles through the use of digital simulation. One of the objectives is to provide builders and suppliers with a methodology and simulation tools for the validation of safe autonomous vehicles. We propose a new methodology based on the concept of oracle, a mathematical tool adapted to the ADASS evaluation. Indeed, oracle created an ideal reference to compare with the answer of a system. The presentation will explain how to create this oracle.

15:45 - Virtual automotive testbeds for automated, reproducible tests

Jörn Thieling, research assistant, Institute for Man-Machine Interaction at RWTH Aachen University, Germany

Today, autonomous vehicles are mainly verified in real-world test drives. These tests are not only time-consuming and expensive but also insufficient for a trustworthy validation, since critical situations rarely occur. To enable efficient system tests, we propose the use of virtual testbeds as a software environment in which 'digital twins' of real vehicles, sensors and environments are simulated (from RWTH). That simulated data is compared with real-world data by using established algorithms for environment interpretation from the automotive sector (with ADASENS input and evaluation).

09:00 - 16:15 - Room B - Test Scenario, Verification and Validation Studies

09:00 - ACU internal fault detection logic evaluation method using semiconductor modelling

Byoungmoo Kwon, research engineer, Hyundai Autron Co Ltd, Korea

The objective of our study is to present an evaluation method through semiconductor modelling of peripheral sensors, which efficiently evaluates the ACU's internal fault detection software logic. This study introduces two different methods to generate internal fault conditions, one by editing a pre-recorded data stream of normal operation, and another by modelling the fault-occurring sectors and adding fault logic blocks to the sectors. We evaluated a test MCU's software with 386 cases of 95 possible internal fault types and achieved a test time reduction of 70% compared with the current method of internal fault testing.

09:30 - Secure testing of ADAS functions using a VRX driving simulator

Günther Hasna, director strategic projects, Optis GmbH, Germany

Optis is developing a simulator software for dynamic ADB headlamp functions, named VRX-Headlamp. Due to physics-based simulation algorithms it is possible to replace real night test drives with virtual simulations. As the ADAS function of the light-assist system is dependent on sensor inputs controlling the headlamp, it was also necessary to develop virtual physics-based sensors as cameras and lidar. For safety ADAS functions like the autonomous emergency braking AEB, it is now possible to do a virtual validation of mandatory NCAP ratings like the pedestrian AEB night tests with the VRX-Sensors software.

10:00 - It's all corner cases: teaching computers to drive safely

Bruno Fernandez Ruiz, co-founder and CTO, Nexar, Israel

As the industry is charging towards self-driving perception in all-terrain, all-weather and all-lighting, it remains a challenge to collect and tag enough data to allow for reliable driving algorithms. Applying user self-annotation of driving data is the only way we can truly advance the autonomous car industry and infrastructure. In this session, I will share our concept and methods in creating an autonomous learning 'flywheel' of collect-annotate-learn road data network.

10:30 - 11:15 - Break

11:15 - A case study of Level 4 test and validation in Korea

NEW

Younggi Song, CEO, SpringCloud Inc, Korea

This presentation will cover self-driving cars and their test and validation procedure. The system consists of multiple sensors and a controller for target vehicles (conventional vehicle and EV). Based on test scenario L4, each task consisted of a 'start, driving, stop and parking' procedure within the test ground. The service point is from ground IoT sensors and vehicle movement information and will provide task performance as defined. The data from SDC is 5 type of dataset and will be continuously monitored by platform service architecture.

11:45 - Autonomous vehicle mode-based testing: generate test cases for 3D simulator

Fabrice Trollet, MaTeLo product manager, All4tec, France

Based on a Renault-Nissan methodology and other R&D projects, this presentation explains how to deal with the huge combinatorics met in ADAS simulation and how to compute related autonomous vehicle expected behaviour, to generate tests cases. The speaker will present the MaTeLo Model-Based Testing process, in which weather, road infrastructure, other motorist behaviour, EGO system, road events, etc. are designed. He will also explain how to design determinist test cases with great variability. From this MaTeLo model, the speaker will show the automatic generation of thousands of scenery samples using Gibbs sampler algorithms, to automatically build Oktal SCANeR scripts for 3D simulation run.

12:15 - Chasing critical situations in large parameter spaces

Dr Mugur Tatar, managing director, QTronic GmbH, Germany

It is commonly agreed that testing and validating highly automated driving functions will involve a mixture of tests in real and simulated environments. Even after a functional decomposition in several classes of base scenarios there always exist many parameters with a huge number of possible values. Testing all combinations of values is impossible. In the presentation we discuss possible approaches and challenges in exploring the large parameter spaces in the search for hidden faults and critical situations.

12:45 - 14:15 - Lunch

14:15 - Assurance of autonomous vehicles with authentic data recordings

Bernhard Kockoth, technology scout, ViGEM GmbH, Germany

Autonomy driving Levels 3-5 are based on a growing number of safety-related systems that must be secured with millions of kilometres. All vehicle bus communications and raw data from sensors, cameras, lidar and radar, as well as status data like weather and actual maps, must be recorded, authentically. An 8hr test drive easily produces 4TBytes of data, if not 20 to 100Tbytes. The data then must be fed to data centres without causing long pauses in vehicle testing. The enormous amount of data becomes a challenge for measurement equipment in automotive environments. New concepts and solutions are presented to meet sophisticated requirements.

14:45 - Meeting the high demand for automated tests – the TestCase Generator

Tobias Weimer, specialist for system and software development, MicroNova AG, Germany

The number of tests required for autonomous and electric vehicles has increased dramatically compared with established standards in the automotive industry. This demand can only be handled by means of automation and adapting existing processes. Therefore, we developed a new solution for the test automation software EXAM, called the TestCase Generator. Its purpose is to generate test cases automatically from a test specification. Now test designers are able to handle 11 times more test cases, deliver test results earlier and cover more requirements.

15:15 - ADAS testing advanced: 6D target mover

Dierk Arp, executive director, Messring Systembau MSG GmbH, Germany

Pedestrians and cyclists account for a significant proportion of road deaths worldwide. Current ADAS test systems are tackling this challenge, but are limited in their design to linear or two-dimensional motion. With this setup, particularly during acceleration processes, an unrealistic motion is generated. The concept of hanging dummies from above creates new possibilities for more life-like dummy trajectories using six degrees of freedom. The system sets new standards in precision and repeatability through the ability to reproduce real-life human motion sequences and imitate them realistically – for example, based on data from a motion capture system.

15:45 - Autonomous vehicle fleet testing – or how to deal with really big data

Dr Sebastian Bode, team manager, IAV GmbH, Germany

Leveraging the potential of fleet testing campaigns of autonomous vehicles equipped with multiple sophisticated sensory systems such as lidar as well as communication systems connecting the vehicle with the IoT, challenges even the most bleeding-edge big data technologies. Getting the most valuable insights into your data and optimising your engineering processes will require tools and services for data acquisition, management, analytics and visualisation. This talk will discuss our testing along the way to a solution that combines the best from the world of big data, cloud, AI and automotive engineering.

09:00 - 12:45 - Room C - V2X Testing & Validation

09:00 - Time-sensitive networking for autonomous driving

Thomas Schulze, head of testing, automotive, Spirent Communications GmbH, Germany

Time-sensitive networking protocols and applications are the enablers for using real-time functionalities in different industries based on Ethernet/IP networks. For the automotive world, TSN will help to implement driver assistance and autonomous functions in next-generation vehicles. The presentation will illustrate use cases of time-sensitive networking in vehicles and also the ways to validate the network components such as ECUs and end devices like cameras and sensors, as well as the software applications using this technology. Learn how autonomous vehicles act like data centres on the road and how to avoid safety issues based on malfunctions.

09:30 - Managing risks of autonomous vehicles

Kwang Sheun Tham, emerging technology lead, IAG Firemark Labs, Singapore

Autonomous vehicles (AVs) have been pitched as being able to significantly improve safety. However, a mixed fleet scenario with AVs and conventional vehicles is deemed a reality for at least the next 10 to 15 years. This poses safety risks arising from interactions between these vehicles. We use data from trials around the world as well as our own analysis to demonstrate reasonable metrics that can be used to evaluate AV risks and human trust in the AVs.

10:00 - V2X communication – a test tool's point of view

Thomas Löffler, manager, Vector Informatik GmbH, Germany

V2X communication is a key enabler for autonomous driving and helps extend the functionality of advanced driver assistance systems (ADAS). The presentation introduces the limitations of today's ADAS systems, and shows why V2X communication is such a hot topic and how it can support ADAS and autonomous driving. It also discusses the measurement and testing challenges involved inv coming up with ADAS applications supported by V2X communication.

10:30 - 11:15 - Break

11:15 - Testing V2X systems by conducting simulations and field tests simultaneously

Frank Brennecke, managing director, Oecon Products and Services GmbH, Germany

C-ITS systems using V2X communications provide opportunities for achieving sustainable transportation. However, before any V2X system is fully developed and deployed, an extensive phase of testing is required. Using dedicated private test tracks and simulations are two main approaches for testing V2X systems. In this paper, a method is proposed for testing V2X systems by using both approaches concurrently and utilising systems such as stereo cameras and roadside stations. The method is aimed to be implemented on a motorway section of the A39 near Brunswick, which is part of the Lower Saxony Test Field for connected and automated driving.

11:45 - GNSS jamming and spoofing

Moshe Kaplan, CTO, GPS Dome Ltd, Israel

During the last few years, the phenomena of jamming and spoofing the GNSS signals has become widespread. The source of jamming and spoofing may be on a national level and on a personal level. GNSS jammers/spoofers are easily obtainable over the net. The future of autonomous driving relies heavily on the availability of GNSS signals, both for navigation purposes and for sensor synchronisation, as well as for V2X synchronisation. It is essential to design autonomous vehicles for operation in jamming/spoofing environments as well as including such facilities in the testing range. GPS Dome provides commercial solutions for jammers/spoofers.

12:15 - Autonomous drive and connected cars: a VTOX business case

Stéphane Barbier, chief development officer, Transpolis, France

The speaker will present a Transpolis business case with an OEM and a traffic-light manufacturer. GLOSA = knowing the position and the current and future status of the next traffic lights to enable the definition of an optimal eco-driving strategy. The driver is advised with an optimal speed in order to get a 'green wave' (pass the traffic light with a green light state), or with a slow-down and stop instruction. The objectives are to reduce stop times, reduce unnecessary acceleration in urban traffic, save fuel and reduce emissions.

12:45 - 14:15 - Lunch

14:15 - 16:15 - Room C - Best Practices

14:15 - Cognitive simulation of the driver for autonomous driving system tests

Jean-Charles Bornard, cognitive engineering and human factors, ESI Group, France

ESI is currently developing a cognitive driver model, which will be integrated into its simulation solution Pro-SiVIC, in partnership with the French Laboratory of Ergonomics and Cognitive Sciences applied to Transport (IFSTTAR-LESCOT). Even though human behaviour and cognitive processes are still unsolved questions, human driver cognitive simulation will allow a better understanding of the driver's state and behaviour. Driver cognition simulation will give autonomous vehicle engineers the ability to test their systems from main concept to HMI specification (human-machine interaction) or system validation, and these tests will integrate key performance indicators of human-like performance and situation awareness.

14:45 - A case study on accelerating lidar development and capability

Mark McCord, vice president of engineering, Cepton, USA

Lidar was used for distance measurement shortly after laser was invented in the 1960s. It remained an exotic metrology technique for almost half a century, until recent development in laser components, together with the intense interest in its autonomous vehicles applications, elevated lidar to the level of 'enabling technology'. In this presentation, we illustrate the complementary capability between radar and lidar while attempting to categorise the latest available lidar techniques by their wavelength, measurement mode and imaging mechanisms.

15:15 - ADAS development on a driver-in-the-loop simulator

Jelle van Doornik, product manager ADAS, Cruden BV, Netherlands

Recent research shows that many people are not well informed about ADAS in their cars. This results in unnecessary and unsafe situations as they learn to use the systems while driving, or do not use the available systems at all. Companies focus on sensors and forget about the most important aspect: the interaction between driver and vehicle. Driver-in-the-loop simulators can be used to create a smoother shared control experience and better transitions when reclaiming control. This enables automotive engineers to create better assistance systems, ultimately resulting in an increase in road transport safety.

15:45 - Could we use DevOps methods to deliver autonomous cars?

NEW

Guillaume Belloncle, smart safe and connected car solution manager, Dassault Systèmes, France

Model-based systems engineering (MBSE) methods have been used for decades by the aerospace industry and are increasingly being adopted within the automotive industry. However, they are sometimes seen as too complex to continuously deliver disruptive innovation for mass markets. Internet companies are continuously delivering innovations using agile software development methods (a.k.a. DevOps), but these methods are limited to delivering safety-critical cyber-physical systems, like a self-driving car. We will outline how mixing these MBSE and DevOps views into an agile MBSE approach can better support the virtual development and validation of autonomous driving technology, leveraging existing industry standardisation initiatives.

NETWORKING EVENING PARTY

Wednesday 6 June, 18:00hrs, Exhibition Hall 5

All delegates and speakers are invited to attend our complimentary networking evening.

Autonomous Vehicle
INTERIOR DESIGN & TECHNOLOGY
SYMPOSIUM EUROPE

5, 6, 7 JUNE 2018, MESSE STUTTGART, GERMANY

INTERIOR DESIGN, DEVELOPMENT AND TECHNOLOGY FOR AUTONOMOUS VEHICLES

UPDATED PROGRAMME

PLUS HMI CHALLENGES AND NEXT-GENERATION ONBOARD SERVICES AND TECHNOLOGY

DAY 1 TUESDAY 5 JUNE

09:00 - 12:45 - *Keynote Opening Session*

09:00 - How to get from expectations to experience in autonomous driving
Christoffer Kopp, product owner – UX autonomous drive, Volvo Car Corporation, Sweden
The presentation will discuss how we do early experience tests of autonomous driving to be able to guide the technology development in the right direction. It will focus on what elements are most important to create trust in the autonomous car. It will also cover the most important aspects to take into consideration to make the user feel freedom when in autonomous mode.

09:30 - Shaping the future of automotive interiors – a vision for innovative seating systems NEW
Thomas Gunkel, design manager, industrial design, Adient, Germany
Disruptive trends like autonomous driving, car sharing or the growing urban population are drastically changing the means of transportation. Using a car in 2030 will be a completely different experience to what we know today. Adient's research and design teams took these trends and other input data and translated them into the compelling AI18 seating concept, which showcases various user scenarios and seating solutions for vehicle transportation beyond 2030.

10:00 - Benefits of augmented-reality head-up displays for automated driving NEW
Bettina Leuchtenberg, expert HMI, ergonomics and usability, Continental Automotive GmbH, Germany
Dr Thomas Vöhringer-Kuhnt, head of HMI user experience and design, Continental Automotive GmbH, Germany
Augmented-reality head-up displays (AR HUD) have been proved to support drivers during manual driving. The presentation shows that drivers also benefit from AR HUD content during autonomous driving situations. Based on an expert assessment, relevant use cases and AR HUD elements have been elaborated. In a driving simulator study with 24 users, an interaction concept with AR HUD content was compared with an interaction concept without AR HUD content. The study shows that most users prefer the AR HUD elements compared with information presentation in an instrument cluster. Takeover quality benefits from the use of AR elements.

10:30 - 11:15 - Break

11:15 - New challenges for HMI in the age of autonomous driving
Rashmi Rao, senior director, advanced engineering, CoC user experience, Harman, Germany
The age of the connected car has clearly demonstrated a need to raise the user experience to a new level. To ensure that autonomous driving is not one day equated with monotony, UX design is becoming the decisive brand factor for OEMs. The presentation will outline what a future-orientated HMI design including AR and VR applications has to look like, and explain why the user experience (UX) will be one of the decisive factors in autonomous or semi-autonomous driving enabling a wide variety of interactions between man and machine.

11:45 - Surf & Curve – HMI ready for SAE 3
Sören Lemcke, head of advanced human interface solutions, ZF TRW BCS, Germany
Within Surf & Curve, ZF-TRW has developed user-centred HMI concepts targeting automated driving of SAE Level 3. Together with the strategic partners FKA mbH and the Institute for Automotive Engineering of RWTH Aachen University, revolutionary HMI concepts were not only developed along several usability studies, but also tested and validated in the high-fidelity and static driving simulator. Among other features, Surf & Curve offers a unique way of lateral control with drivesticks, mirror replacement and comfort control ready for automated driving of SAE Level 3.

12:15 - Creating 'magic' in the seats for autonomous driving NEW
Marc van Soolingen, Global design director seating, Faurecia, France
The presentation will cover: radical change – traditional premium and new premium; from mega trends to product directions; differentiating seating value; values of today and values for tomorrow; designing developments for new expectations; transformer magic – beautiful structure, advanced versatile structure, enabling new activities; new safety setup; digital magic – integrated screen, natural motion, fusion smart tiles; solutions for intuitive seat controls, technology in surface; integration magic – controlling complexity, seamless integration, home feeling in car, complete seat, UBA integration; health and wellbeing magic – short storytelling around active wellness and closed-loop comfort; conclusion –our development directions for AD cars.

12:45 - 14:15 - Lunch

14:15 - 18:00 - *Afternoon Session*

14:15 - The automotive cocoon
Dr Dominique Massonié, product manager - HMI, Elektrobit Automotive, Germany
Impacted by rapidly evolving consumer electronics technology and new automotive business models, the car is now a connected object that is set to become an extension of someone's home and office. This raises an interesting question: what factors need to be taken into consideration when creating automotive interiors? This presentation will provide insights into emerging challenges for automotive user interface design and then focus on how in-car interfaces can be designed to deliver experiences that are specific to the user; the tools one needs to create these interfaces; and the roles usage-, user- and context-specific information will play.

14:45 - Will parallel industries and non-traditional OEMs drive the autonomous cars of the future?
John Tighe, design director transport, JPA Design, UK
Through several years of experience and understanding of customer behaviour within aircraft and many other transport fields, JPA tells the story of Person X's life in 10-15 years; what their needs will be, what will be available to them, what is relevant and how this will influence the autonomous vehicle interior design of future. We will discuss the package and seating layout, which is one of the most important factors when designing successfully for autonomous cars. What we've witnessed coming from automotive brands often seems to be blinkered and anchored in the past, which brings risk of being leapfrogged by those outside the traditional automotive industry.

15:15 - Real-estate design opportunities of autonomous cars
Richard Seale, lead automotive designer, Seymourpowell, UK
The advent of autonomous technologies will have a huge effect on the rule book that designers have to play with, significantly throwing open the functional and aesthetic potential for our future vehicles and travel. This shift will be largely led by both the change in safety regulations, and the switch from a driver-based model to a passenger-based model – bringing unparalleled opportunities to customise our vehicles. The seismic shifts that autonomy will bring will open Pandora's box, and nowhere will this be more obvious than in the interiors of our future cars. We will explore original concepts in this presentation.

15:45 - 16:30 - Break

16:30 - Mobile Livingroom 2.0
Moritz von Grotthuss, CEO, Gestigon - a Valeo brand, Germany
Most experts expect the car to be the third place of living aside from our home and our office. Longer distances to commute, more traffic, more time in the car are already creating this reality today. But how can we avoid this development turning out to be our personal mobile dystopia? How do we create a place to be and a place where we like to be? HMI, AR, Interior Cocoon and new perceptual safety features are core to create a Mobile Livingroom 2.0. These concepts will be introduced, explained and discussed in this presentation.

17:00 - Highly accurate reference system for validation of driver monitoring
Heiko Ruth, head of system department, CMORE Automotive, Germany
Due to upcoming functions on HMI interfaces such as augmented reality, 3D displays and autonomous driving on SAE Level 3, driver monitoring is becoming increasingly important. With C.REF – a reference and ground truth block set for test and validation of several KPIs – CMORE has wide experience with forward-looking ADAS sensors. With the new C.REF Gaze and C.REF Head block set, two new functions in the reference block sets for interior observation have been developed. These block sets give the development team of a DMS system a new dimension of accuracy within the whole development process.

17:30 - Lounges on wheels?
Dr Cyriel Diels, academic director, National Transport Design Centre, Coventry University, UK
Shared and automated mobility may make our journeys more pleasurable and productive. Future vehicles are envisioned as 'lounges on wheels', sporting flexible seating arrangements with interiors dotted with screens. This presentation will explore these proposals from a human-centred design perspective and discuss the necessity to respect basic human requirements to realise the potential benefits such shared and automated vehicles may be able to provide.

DAY 2 WEDNESDAY 6 JUNE

09:00 - 12:45 - *Morning Session*

09:00 - Understanding occupants' visual behaviour – AI inside autonomous vehicles
Modar Alaoui, CEO, Eyeris, USA
This session will cover the latest embedded vision AI technologies that enable visual behaviour understanding for the driver and passengers of autonomous and highly automated vehicles (HAVs). Critical to ensuring safety and comfort for all occupants, the intelligent software uses standard cameras to provide emotion recognition from facial micro-expressions, 30+ face analytics, body pose tracking, action and activity recognition. In the second half of this session, we will cover a number of metrics that trigger the activation of support systems, and others that enhance the overall ridership experience.

09:30 - A visual aid against motion sickness
Dr Paolo Pretto, research team leader, Max Planck Institute for Biological Cybernetics, Germany
Anecdotal evidence indicates that car passengers develop motion sickness when they experience unexpected and/or sustained discrepancies between physical and visual motion cues (e.g. while reading during the travel). This issue is likely to become more deleterious in autonomous vehicles, where passengers may be facing away from the driving direction and engaged in non-driving activities. We are testing the efficacy of in-car solutions that will constantly display to all passengers additional, non-invasive visual information on the current and imminent vehicle body motion. The goal is to minimise the perceived sensory mismatch and increase passengers' situational awareness, thus improving safety and comfort.

10:00 - Autonomous mobility 2050: four potential transformative outcomes for vehicle interiors
Carlo Budtke, senior consultant, P3 Group, Germany
Carlo Budtke will explore the extremes between different approaches in the industry using four examples considering potential future market dominance by each of the following: automotive OEMs, shared mobility, tech giants and disruptive startups. Based on the scenarios explored at the Autonomous Vehicle Interior Design & Technology Symposium in 2017, new approaches and expanded concepts including relevant examples will be presented. The conclusion drawn is that different markets will see different market shares of these four examples, depending on the demographic characteristics. This will strongly impact on the user interaction with the vehicle interior and configurations of each extreme.

10:30 - 11:15 - Break

11:15 - User-centred design of autonomous driving systems in trucks
Arnd Engeln, professor for market and advertising research, traffic and transport psychology, Stuttgart Media University, Germany
In the TANGO scientific research project, sponsored by the German BMWi and in cooperation with Bosch, MAN, VW and Stuttgart University, we developed an activity and vigilance management system for truck drivers using a user-centred design process (UCD). We first observed and interviewed truck drivers in their daily work to find out their needs for assistance. Based on this, we conceptualised innovative ideas to keep drivers active and vigilant in phases of automatic driving on Level 2 and 3. In our further UCD process, these ideas are developed and evaluated in an iterative process. Interim results will be shown.

11:45 - Personalising the autonomous vehicle interior with flexible plastic LCDs
Simon Jones, commercial director, FlexEnable, UK
With the gradual transition to autonomous cars, the HMI will have to address the entertainment, information and communication needs of the passengers. As displays become more and larger, it is increasingly difficult to accommodate flat displays in an ergonomically optimised interior design where every other surface is curved. A new type of low-cost flexible display technology, plastic OLCD, now provides a viable solution for future cars where large area, high brightness and long-lifetime displays are needed. OLCD uses LCD technology, which is already qualified for automotive displays, with the added benefit that it can be conformed and shaped.

12:15 - Inducing trust: AI-powered assistants as spokespeople for the autonomous vehicle
Dr Nils Lenke, director corporate research, Nuance Communications, Germany
AI-powered automotive assistants (AA) play an increasing role for today's drivers, enabling them to interact with their vehicles while driving. An interesting question is how this will change with the advent of the autonomous vehicle (AV). One view is that drivers as passengers in AVs will no longer need to use speech. This paper argues the opposite. Drawing from the literature and new usability studies and research it shows that AAs can play a crucial role in building up the necessary trust in the users of AVs. It will also show that in AVs there is a practical need to interact with AAs.

12:45 - 14:15 - Lunch

14:15 - 18:00 - *Afternoon Session*

14:15 - Levelling up: an HMI roadmap for Level 3 and 4 autonomous transport
Derek Viita, senior analyst, in-vehicle UX service, Strategy Analytics, USA NEW
What lessons have we learned from rollout of early semi-autonomous systems? What are best practices and common pitfalls observed in HMI designs of these systems? And what lessons can we apply to improve usability of and encourage trust in more automated systems? In this presentation we look at the current state of on-market semi-autonomous HMI, how this has affected interest in and attitudes towards autonomous transport, and next steps for more automated transport, all through the lens of worldwide consumer research.

14:45 - Individual differences in trust, perception and usage of automated systems
Dr Tanja Schweiger, manager, automotive solutions, J.D. Power Europe GmbH, Germany NEW
Recent J.D. Power international studies performed in the USA, China and Germany show many cultural differences concerning individuals' trust in automated vehicles. A deeper look shows that besides cultural differences there are also many age and gender differences that should be considered when developing automated systems. These differences concern not only the trust in these systems, but also the perception and usage of them, including many interior and HMI aspects.

15:15 - 3D sensing infrastructure for next-generation in-cabin applications
Dr Gregor O Novak, managing director, Becom Bluetechnix GmbH, Austria
For today's advanced driver assistance systems and for the next step in autonomous driving, it is important to know what is going on inside the vehicle. A depth-sensing infrastructure based around time-of-flight 3D sensors and VCSEL illuminations combined with embedded processing provides the necessary sensor data to recognise driver and passengers. Based on the driving mode, increased safety through correct pose detection and a broad array of comfort functions for all users can be realised. Increased context and user awareness of the system enable a more intuitive user experience and novel HMIs.

15:45 - 16:30 - Break

16:30 - Occupant restraint dilemma for autonomous vehicles
Dr Gopal Krishnan Chinnaswamy, senior project engineer, Virtual Engineering Centre, University of Liverpool, UK
The Industry 4.0 revolution is enabling the development of automated driving without interference (autonomy). Connected vehicles are expected to be more common in the coming years, and fully autonomous (L5) vehicles are expected within a decade or two. Autonomous vehicles will require sufficient features to ensure the safety of the occupants even when their positions are not structured as at present. This paper addresses the issues brought about by the autonomy revolution and particularly Level 5 autonomy. It also assesses the need for, and proposes possible solutions to, the occupant safety conundrum.

17:00 - Creation and evaluation of a Level 5 driverless pod design
Joscha Wasser, researcher, Coventry University & Horiba MIRA, UK
Driverless last-mile mobility vehicles, also known as pods, are on the verge of becoming a reality accessible to the wider public as part of public transport systems. However, little is currently known about the passenger requirements for these vehicles. We therefore proposed a comfort model for driverless pods, presented at the Autonomous Vehicle Interior Design & Technology Symposium 2017, which was then used as a basis for the design of a four-seater driverless pod. A digital prototype and an ergonomic buck were then used to conduct participant lead ergonomic evaluations of the interior and to validate our proposed model.

17:30 - Virtual prototyping to virtually test passenger comfort and safety
Caroline Borot, business development industry solutions, ESI, France
This paper investigates how virtual interior prototyping and digital human models can be used to find the right car interior design, optimising the comfort of occupants and their safety in a completely new, innovative interior layout. After a brief description of ESI digital thermal human models and virtual seat model, it will show through different industrial use cases, how the (dis)comfort of the passenger can be virtually tested and optimised at the early stage of the car interior design.

DAY 3 THURSDAY 7 JUNE

09:00 - 12:45 - *Morning Session*

09:00 - Functional interior lighting: cognition, orientation, wellbeing and safety
Dr Frederik Diederichs, senior researcher, Fraunhofer IAO, Germany NEW
Automotive interior lighting is an emotional feature. Light affects our biological clock and cognition. It guides attention, counteracts motion sickness and acts as a natural interface in our mobile smart home 4.0. Light in the automotive interior can be a unique selling point and create corporate identity. The fully styled car interior offers best integrated light-emitting surfaces for an adaptive UX. And there are more surprising functional light effects on humans, as we demonstrated in the luxury Level 5 Audi Concept Car in the 25th Hour project.

09:30 - VI-DAS HMI for user-centred automation
Paul Schouten, UX designer, TomTom, Netherlands
The presentation will outline an iterative user-centred design study to find solutions for how to allow the VI-DAS user to anticipate what's ahead using contextual sensor data, to support a safe and comfortable user-vehicle collaboration for different levels of vehicle automation.

10:00 - UX 2025: investigating the user experience in the connected cockpit of 2025
Patrice Reilhac, innovation and collaboration research director, Valeo, Germany
A clear vision of megatrends and technological progress is fundamental for envisioning the future

cockpit. Automation Levels 3 and 4, 5G connectivity and AI-enabled adaptive and personalised content allow the future cockpit to be highly focused on the human. Valeo presents investigations on its Cockpit 2025 concept for intuitive driving and travelling of future highly digital users.

10:30 - 11:15 - Break

11:15 - HMI for intuitive and adaptive transitions

Dr Alessia Knauss, research specialist, Autoliv Research, Sweden

Transitions between automated vehicle and manual driving represent one of the major challenges in autonomous driving. In order for the driver to be useful, they should be intuitive and adaptive to the driver state, the environmental situation, and personal preferences and characteristics of the driver. This talk will focus on the HMI as an element to make transitions more intuitive and adaptive. Application examples based on different HMI elements (e.g. smart steering wheel) will be presented.

11:45 - Human and automation as team members: the AutoMate project

Dr Andreas Lüdtke, group manager, Offis, Germany

The presentation describes the concept, process and findings of the AutoMate project. The vision of AutoMate is a novel driver-automation interaction and cooperation concept to ensure that highly automated driving systems will reach their full potential and can be commercially exploited. This concept is based on viewing and designing the automation as the driver's transparent and comprehensible cooperative companion or teammate. This kind of system can enhance safety and comfort by using the strength of both the automation and the human driver in a dynamic way.

12:15 - VI-DAS Project – a novel approach to next-generation vehicle interaction

Dr Oihana Otaegui, head of ITS and engineering department, Vicomtech, Spain

VI-DAS will progress the design of next-gen 720° connected ADAS (scene analysis, driver status). Advances in sensors, data fusion, machine learning and user feedback provide the capability to better understand driver, vehicle and scene context, facilitating a significant step along the road towards truly semi-autonomous vehicles. Predictions on outcomes in a scene will be created to determine the best reaction to feed to a personalised HMI component that proposes optimal behaviour for safety, efficiency and comfort.

12:45 - 14:15 - Lunch

14:15 - 16:15 - *Afternoon Session*

14:15 - Feeling your car: HMIs as envisioned by the VI-DAS project

Dr Margarita Anastassova, research engineer, CEA LIST, France

The VI-DAS vision of future in-vehicle HMIs for autonomous and semi-autonomous driving has a special focus on HMIs providing multi-sensory alerts and improving drivers' situation awareness. An approach to integrating such HMIs in regular driver activity when driving and being driven will be presented.

14:45 - How can I help my autonomous vehicle?

Elisa Landini, programme manager, RE:Lab, Italy

This presentation describes the innovative interaction paradigm between drivers and highly automated vehicles, developed in the AutoMate EU project. This new interaction modality is based on cooperation, i.e. mutual support in perception and action between the driver and the car. The cooperation aims to exploit and make concrete the complementarity of the human and the automation as part of a team. The tool able to allow the cooperation is the HMI. In the project, when the human should compensate a human limit, a negotiation-based HMI is implemented to cooperate with the driver, increasing comfort and acceptability.

15:15 - Driver-state-based HMI in automated driving: the ADAS&ME approach

Stella Nikolaou, researcher, CERTH/HIT, Greece

The introduction of automated functions in vehicles brings a new set of possibilities, but also several challenges. It is no longer just the driver using the vehicle as a tool for transportation; instead, the driver and the vehicle work together as a team. ADAS&ME is an EU-funded project targeting the development of adaptive ADAS, able to decide when and how the vehicle needs to take over or recover control based on driver's state and the environmental context. The approach uses adaptive HMI strategies to assist the driver with automation when needed, and to achieve smooth transitions between automated and manual driving.

"Great conferences for international networking and inspiring presentations. The conference meets the trends and is well balanced between future concepts and innovative solutions for current challenges."
Frederik Diederichs, Engineering System / Human Factors Engineering & Vehicle Interaction, Fraunhofer IAO

NETWORKING EVENING PARTY

Wednesday 6 June, 18:00hrs, Exhibition Hall 5
All delegates and speakers are invited to attend our complimentary networking evening.

DAY 1 TUESDAY 5 JUNE

09:00 - 12:45 - *Keynote Presentations*

09:00 - Automated road friction estimation using car-sensor suite: machine learning approach
Mats Jonasson, technical expert, Volvo Cars, Sweden
Automotive active safety systems can significantly benefit from real-time road friction estimates (RFE) to adapt driving styles specific to the road conditions. This work focuses on using the Volvo car-sensor suite for road friction estimation and prediction tasks using machine learning algorithms. First, the most significant sensors for RFE estimation are detected by feature ranking, including: ambient temperature, GPS location, vehicle speed, forces and road surface, tyre types. Next, image processing modules are invoked to detect the drivable surface condition. Finally, information from processed segments of road images will be fused with vehicle dynamics sensors to initiate RFE-related warnings.

09:30 - Artificial intelligence in the driver's seat
Serkan Arslan, director of automotive, Nvidia EMEA, Germany
Artificial intelligence is transforming every industry, but perhaps none more than transportation. From how we interact with vehicles, to how they drive us, to how our city's infrastructure will automatically adjust to reduce traffic congestion, deep learning will play a vital role. Nvidia is building AI platforms for autonomous vehicles as well as smart cities. The talk will provide insight into and showcase demonstrations of the existing state of autonomous vehicles in development and in production, as well as discuss the steps to fully autonomous Level 5 robo-taxis.

10:00 - Cognitive IT with storage and software defined solutions for ADAS
Frank Kraemer, systems architect, IBM, Germany
Advanced driver assistance systems (ADAS/autonomous driving) are becoming part of all vehicles. All major OEM and Tier-1 auto manufacturers are implementing and testing AD facilities. We examine how real-time sensors, big data computing, data storage and data archiving are integrated in today's ADAS/AD systems, providing a fascinating case study, best practices for workflow design, testing and development, data storage and archiving, applicable to all industries. Come hear a fascinating investigation of an industry/technology that will soon affect us all, every day.

10:30 - 11:15 - Break

11:15 - Accelerating connected and autonomous vehicles through open-source software
Dan Cauchy, executive director, Automotive Grade Linux, The Linux Foundation, USA
The race to roll out new technology features and autonomous vehicles continues to heat up. To compete at the speed of a tech company, many auto makers have shifted from traditional development processes to agile, rapid development through open-source software. Dan Cauchy will provide an overview of AGL, key milestones and the project roadmap. He will also discuss AGL's vision for functional safety as well as for an open-source platform for autonomous driving that will help accelerate the development of self-driving technology while creating a sustainable ecosystem that can maintain it as it evolves over time.

11:45 - Contract-based design of automotive software systems
Fabio Urciuoli, business development manager, Siemens PLM Software, Germany
Organisations have long struggled to break down large, complex embedded applications into manageable isolated components and boost cross-functional collaboration. It is clear that automotive OEMs, suppliers and involved system designers are faced with several challenges. We believe that an architecture-driven development associated with contract-based design will be helpful for software teams to be synchronised from start to finish and to efficiently manage the integration activities from the start. The proposed workflow will provide industrial value impact in terms of early design error detection, predictable integration of the system, reduced release time and flexible organisation level adoption.

12:15 - AUTOSAR adaptive platform for intelligent vehicles
Dr Thomas Scharnhorst, spokesperson, AUTOSAR Development Partnership, Germany
AUTOSAR Classic was released more than 10 years ago, with the first release entirely intended for the embedded architectures of classical ECUs. AUTOSAR has now developed a completely new approach – AUTOSAR Adaptive Platform – to cope with the challenging environment of internet access in cars to make vehicles intelligent and adaptive. This aims to support dynamic deployment of customer applications in providing an environment that requires high-end computing power and connects deeply embedded and non-AUTOSAR systems in a smooth way while preserving typical features originated in deeply embedded systems like safety.

12:45 - 14:15 - Lunch

14:15 - 18:00 - *Afternoon Session*

14:15 - Virtual validation techniques for CNN-based ADAS/AD systems
Vignesh Radhakrishnan, senior ADAS/AD systems engineer, AVL, UK
Virtual validation will become an important aspect of ADAS/AD development. However, there is an urgent need to define techniques for validating AI-based ADAS/AD systems. Due to the stochastic nature of AI systems, the challenge is to make sure the systems act as per defined requirements. AVL is leading a research project – SAVVY (Smart ADAS Verification & Validation Methodology) – funded by Innovate UK, which is addressing the challenge of defining a process to validate CNN-based ADAS/AD systems.

14:45 - Challenges of neural networks for vehicle software
Joshua Davis, software engineer, Horiba MIRA, UK
In recent years, artificial neural networks have been shown to be very effective at learning high-level semantic information from unstructured data such as audio, image and video, modelling complex non-linear relationships between input and output signals and allowing us to make sense of the world around us. This paper will give a brief introduction to neural networks, discuss some of the big challenges that we have seen putting them to use in autonomous vehicle applications such as training and validation, and review some of the methods being used to overcome these challenges.

15:15 - Complex deep learning software stacks – revealing their inner secrets
Illya Rudkin, principal software engineer/safety-critical software development lead, Codeplay Ltd, UK
The integration of complex software with hardware while meeting tight development constraints is a challenge for all automotive companies. For functional safety engineers the scope of concerns with an expanding code base supporting diverse hardware is immense. Khronos moves open standards APIs such as OpenCL and OpenVX to be ISO 26262 compatible software/hardware enablers. Codeplay will show, using Tensorflow as a use case, how a holistic toolchain with open standards can manage complex software stacks using SYCL and OpenCL. This helps to enable developers and safety functional engineers to manage issues such as power usage and concurrency timing while mitigating safety concerns.

15:45 - 16:30 - Break

16:30 - Efficient training and testing of autonomous vehicle AI using simulation
Rodolphe Tchalekian, EMEA pre-sales engineer, ESI GmbH, Germany
Massive amounts of labelled and unlabelled datasets are needed both for training autonomous vehicles to navigate complex and unexpected scenarios, and to evaluate that training. As a substitute for hours of recordings, Pro-SiVIC creates synthetic data to simulate the output from multiple sensor systems for outdoor scenarios that combine vehicles, obstacles, pedestrians, weather and road conditions. We will demonstrate how a platform running deep learning algorithms can receive and process Pro-SiVIC data in real time. Some application examples will be provided to illustrate how simulation could significantly improve the current methodology for training and validation of neural networks.

17:00 - Preparing for the inevitable data growth challenges of ADAS
Larry Vivolo, senior business development manager, automotive and electronic design automation, Dell EMC, USA
The growing number of high-resolution sensors in cars is driving new data management challenges for ADAS simulation and development. A single sensor for SAE Level 3 autonomy can consume >4 PB of storage to simulate 200,000 driven kilometres. SAE Level 5 may require 240,000,000km. Legal obligations may require sensor data archiving for decades, with only days for recovery. Machine learning will set new performance requirements, all while IT budgets shrink. During this sessions we will review how distributed file systems help solve these conflicting requirements and how to architect your data centre to meet future regulations and requirements for capacity, performance, collaboration and growth.

17:30 - Using compilers for safety-critical systems
Dr Marcel Beemster, CTO, Solid Sands BV, Netherlands
Compilers are 'just' tools in, for example, the ISO 26262 functional safety standard for the automotive industry. Developers prefer to do on-target application testing over compiler qualification. However, this does not take into account the complexity of a compiler and the artefacts it introduces into the generated code. Without detailed knowledge of the compilation process from source code to machine code, it is incorrect to assume that high code and branch coverage at the application source code translates to similarly high coverage at the machine code.

DAY 2 WEDNESDAY 6 JUNE

09:00 - 12:45 - *Morning Session*

09:00 - Deep learning on Hadoop
Dr Tobias Abthoff, member of the executive board, NorCom Information Technology AG, Germany
The software stack of autonomous vehicles increasingly consists of deep learning networks complementing traditional software. The development and particularly the verification of such networks requires completely new paradigms. We will present a new way of efficiently training and verifying deep neural networks by combining deep learning with state-of-the-art big data technology. The approach targets globally distributed teams in particular, and also distributed non-movable test data. The general architecture will be presented and then an actual use case in the field of image understanding will be shown in detail.

09:30 - Making cameras self-aware for autonomous driving
Dr Florian Baumann, technical director, Adasens Automotive GmbH, Germany
Two fundamental algorithms addressing the issue of making cameras self-aware of their status are proposed: online targetless calibration based on optical flow, and blockage detection based on image quality metrics (e.g. sharpness and saturation). The online calibration is based on the vanishing point theory; the soil/blockage detection is based on the extraction of image quality metrics and the identification of discriminative feature vectors by a support-vector machine. The presentation will include videos and real-world examples from the algorithms running in real time.

10:00 - The amygdala of the self-driving car
Raul Bravo, CEO, Dibotics, France
When using the human brain as a model for intelligence, the human amygdala allows for ultra-fast, deterministic and effortless (low-power) reaction, while the neocortex allows for complex thinking (after learning and spending significant energy). Nobel Prize winner Daniel Kahneman calls these two different processes fast thinking (System 1) and slow thinking (System 2). Right now, most of the attention in autonomous car development is in using System 2 thinking. AI/machine learning is an excellent parallel to the neocortex of the human brain. We have developed the artificial amygdala and will give a live demonstration of how it works.

10:30 - 11:15 - Break

11:15 - Autonomous fleet management — challenges and opportunities
Pejvan Beigui, CTO, EasyMile, France
Fleet management is a key component of the coming autonomous vehicle-based mobility as a service revolution. At EasyMile, we are the centre of this revolution as we have been designing both the EZ-10 autonomous shuttle and the software stack required for autonomous driving. We have helped transport operators around the world with operating fleets of EZ-10. Our fleet management solution has been architected for high availability, fault tolerance and high scalability, while maintaining other key properties such as cybersecurity and agility. In this talk, we will discuss the challenges we've faced building this system, and present some of our key results.

11:45 - Safety-reinforced AI driver development
Dr Edward Schwalb, lead scientist, MSC Software, USA
Safety must be a major focus for automated vehicle (AV) development. Today humans drive 100 million miles between fatal crashes. Consequently, proving that a specific revision of an AI driver is safe is not practical using road and track tests; neither investigations of Tesla's crash nor Waymo driving records resulted in conclusive results. State-of-the-art machine learning approaches, e.g. measuring F1 score, are inadequate to measure failure rates of a few in a billion; a 99.999% F1 score is not considered meaningful. We describe an approach for safety-reinforced training, and analysis of perception and decision components using simulation.

12:15 - Operating and optimising autonomous vehicle fleets – distributed cloud platform
Zhao Lu, CTO, BestMile, Switzerland
The benefits of autonomous vehicles can only be leveraged when integrated into a coherent and coordinated mobility system. Challenges lie in how mobility providers will be able to offer services with autonomous vehicles when they can no longer rely on drivers and current software is not sufficient. There is a clear need for a platform to create coordinated, efficient, flexible and sustainable mobility services in which autonomous vehicles are operated and optimised as a fleet, meeting real-time demand or adhering to a schedule while adapting to network disruptions. The paper will detail the technical specificities of such a platform.

12:45 - 14:15 - Lunch

14:15 - 18:00 - *Afternoon Session*

14:15 - Producing systems that enable the innovation that autonomous vehicles will require
Agustin Benito Bethencourt, principal consultant - FOSS, Codethink Ltd, Spain
In order for autonomous vehicles to react to new situations and demands, software and data will need to be updated on a regular basis, which requires the way in which software systems are produced today to be turned upside down. With Open Source best practices and agile principles in mind, along with a background in other industries, Agustin will go over some of the key changes that auto makers and Tier 1s will need to face in the near future to enable all that innovation in vehicles in a sustainable way. He will focus on delivery and maintenance processes and practices.

14:45 - Autonomous vehicles: providing software features quickly by model-based system design
Sébastien Christiaens, department manager, FEV Europe GmbH, Germany
Autonomous driving vehicles are complex systems. Existing processes for component-orientated development reach a limit. New approaches are required to provide safe and affordable solutions. System modelling approaches offer the opportunity to smooth the steps from customer requirements to software development, and enable reuse and front-loading, leading to considerable effort and time reduction for integration and testing. This presentation shows how a systematic approach to system requirements definition can practically be applied to the development of autonomous driving vehicle functions. The different modelling layers will be explained, and the benefits of the approach will be discussed and illustrated through practical examples.

15:15 - Building artificial brains that learn driving better and more quickly than humans
Karim Mansour, vice president and co-founder, Sigra Technologies GmbH, Germany
This talk will concentrate on how artificial intelligence can help build sophisticated brains that can drive in complex scenarios. It will look at how these brains can react much more quickly than human brains, and how they can detect future hazards using simple data that human beings can simply ignore or can't detect or see.

15:45 - 16:30 - Break

NEW
16:30 - Running a functional and open HAD software architecture on an Adaptive AUTOSAR infrastructure
Rudolf Grave, head of product systems architecture, Elektrobit Automotive GmbH, Germany
This talk will explain how functional software architecture with open interfaces and software modules can be integrated on a high-performance micro-controller using Adaptive AUTOSAR middleware. In addition to the functional challenges, the handling of automotive safety integrity levels will be shown. The benefit of an open software framework for automated driving combined with a dependable operating environment is increased time to market due to fast integration and early testing on a system level.

17:00 - Updating autonomous vehicle software remotely – even over non-secure channels
Alberto Troia, memory system architect, Micron Technology Inc, Germany
For autonomous driving to become mainstream, passengers must trust the autonomous vehicle enough to give up driving control. As a broader component of that trust, it will also be essential for OEMs to implement an infrastructure to securely support software updates over remote, non-secure channels as Secure Over-The-Air (SOTA) software updates become mainstream. In this paper, we will present a methodology based on remote diagnostic software technologies to establish the authenticity of the vehicle and associated software updates. This methodology will prohibit cyberattacks when software is being downloaded or uploaded from the vehicle.

17:30 - The zero-defect software factory – myth or reality?
Ingo Nickles, senior field application engineer, Vector Software, Germany
Software development can no longer be considered as a creative process leading to mastery of how the function and logic is expressed in the application's lines of code. Because the role of software is to deliver key features and safety-critical functions in so many pieces of equipment and systems, it now needs to be constructed with the precision and quality that can be seen in any modern manufacturing process. This presentation will discuss whether a zero-defect software factory can be a reality.

DAY 3 THURSDAY 7 JUNE

09:00 - 10:00 - *Morning Session*

NEW
09:00 - Hive mind: AI and ML for vehicle and fleet
Herman Coomans, senior solutions architecture manager, Amazon Web Services, Australia
Machine learning models require massive compute resources for training, but can be deployed with much more modest compute in-vehicle. Edge compute with machine learning can be used for fast decision making in the field, and vehicle fleet data, maps and other sources can be used for navigation and fleet training tasks in the cloud. Attendees will learn how to leverage both edge compute and a shared AI/ML platform without having to build the underlying IT infrastructure.

NEW
09:30 - Only as good as your data
Sheikh Shuvo, product and solutions manager, Mighty Ai, USA
To achieve Level 5 autonomy, vehicles must be able to process and respond to so-called 'edge cases' that rarely occur and are hard to account for. Teams around the world have collected terabytes of raw sensor data and must now sift through that data to uncover the moments that capture these rare objects and scenarios. In this presentation, we discuss the challenges behind developing a system to sort through this immense amount of data, and how to label that data accurately and at scale. Additionally, we examine best practices for using manual annotation when accuracy is critical.

NETWORKING EVENING PARTY

Wednesday 6 June, 18:00hrs, Exhibition Hall 5
All delegates and speakers are invited to attend our complimentary networking evening.

NEW FOR 2018!

EXCLUSIVE HANDS-ON WORKSHOPS FOR ACCELERATING AI AND DEEP LEARNING AND END-TO-END DEVELOPMENT OF AUTONOMOUS VEHICLES

10:30 - 12:00 - *Morning Workshop*

NVIDIA DEEP LEARNING INSTITUTE

The Nvidia Deep Learning Institute (DLI) offers hands-on training for developers, data scientists and researchers looking to solve challenging problems with deep learning and accelerated computing.

Join us for a hands-on DLI workshop called Introduction to Object Detection with TensorFlow. This workshop is a lightning introduction to object detection and image segmentation for data scientists, engineers and technical professionals. This task of computer-based image understanding permeates many major fields such as advertising, smart cities, healthcare, national defence, robotics and autonomous driving. Ultimately, the goals of this course are to provide a broad context and clear roadmap from traditional computer vision techniques to the most recent state-of-the-art methods based on deep learning and convolution neural networks (CNNs).

If you do not have any experience with deep learning, we recommend you take at least the Image Classification with DIGITS lab from www.nvidia.co.uk/dlilabs prior to attending.

14:15 - 16:15 - *Afternoon Workshop*

SIEMENS

We are delighted to announce that Siemens will be hosting a world-first workshop in Stuttgart this year. Co-hosted with Mentor and TASS International, this session will provide insight on the end-to-end development of autonomous vehicles, with subjects including:

- Model-based development, verification and validation framework for automated vehicles
- Framework consisting of advanced simulation environments (MiL, SiL, HiL, ViL) as well as physical testing facilities (laboratories, test tracks, public roads)
- Facilitating the full spectrum of automated driving technology, ranging from system-on-a-chip design, sensor development and systems integration to full-vehicle performance evaluation and traffic impact analysis

All delegates are welcome to attend this exclusive workshop. The Siemens team are focused on delivering an educational platform for participants that will result in a more streamlined, robust and faster automated vehicle development process.

Access to both workshops is included in the delegate pass fee!

LOOK WHO IS SPEAKING...

KEY COMPANIES INCLUDE:

Allianz Automotive · BOSCH · b-plus · RENAULT

AVL · HYUNDAI AUTRON · dSPACE · SIEMENS Ingenuity for life

Audi · Provincie Noord-Holland · DELPHI · TÜV SÜD

NATIONAL INSTRUMENTS · HARMAN · DEKRA · MIRA

tass international A Siemens Business · VOLVO · Elektrobit · NVIDIA

TNO innovation for life · Autoliv · ZF TRW · Valeo SMART TECHNOLOGY FOR SMARTER CARS

TOMTOM · gestigon a Valeo brand · Continental · AUTOMOTIVE GRADE LINUX

IBM · AUTOSAR · DELL EMC · ADIENT

GO ONLINE TO VIEW THE FULL LIST OF SPEAKERS
www.autonomousvehiclesymposium.com

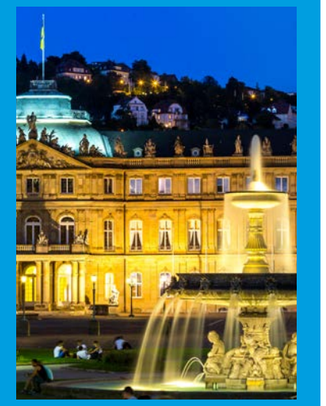
EVENT INFORMATION

STUTTGART

Messe Stuttgart
Due to its location between the airport and motorway, Messe Stuttgart Trade Fair Centre has an incomparable traffic infrastructure. Direct connections to the A8 motorway, the B27 trunk road, the airport, the S-Bahn (rapid-transit railway) – and, in future, the planned railway station for local and long-distance trains – ensure that visitors and exhibitors will be able to travel quickly and easily to the Trade Fair Centre.

The journey times to a large number of hotels are also surprisingly short. Stuttgart city centre can be reached in around 20 minutes by S-Bahn.

The City
Stuttgart is a city with many varied attractions, Porsche and Mercedes-Benz museums, a world-renowned ballet, excellent cultural and sporting highlights, diverse leisure and accommodation possibilities and an international variety theatre.



CONFERENCE PACKAGE INCLUDES

- Access to all conferences at the Autonomous Vehicle Test & Development Symposium 2018
- Invitation to the drinks and networking reception evening
- Event app to arrange your individual conference schedule and meetings
- Pre-conference coffee on arrival
- Lunch and refreshments at Conference Dining
- Assorted complimentary refreshments during the conference networking breaks
- Access to a secure website containing all presentations made during the conference (subject to speaker approval)
- Visitor Meetings & Relaxation Area for sit-down discussions
- Free-of-charge cloakroom
- Complimentary wi-fi

CONFERENCE RATES

10% EARLY-BOOKING DISCOUNT

3-day pass	~~€1,950~~	€1,755 + VAT
2-day pass	~~€1,750~~	€1,575 + VAT

Group booking discount
Receive an extra **10% discount** on each registration for a group booking (2+ delegates) by making them on the same date, from the same company.

OPENING TIMES

Tuesday 5 June
Networking Breakfast 08:15 – 08:50
Conference Opening Hours 09:00 – 18:00

Wednesday 6 June
Conference Opening Hours 09:00 – 18:00

Thursday 7 June
Conference Opening Hours 09:00 – 16:15

HOTELS & TRAVEL

Book directly through our official partner, RAI Hotel Services, so you can easily find accommodation that meets your requirements and suits your budget.

• Profit from the best rates • No administration or handling fees
• Wide selection of hotels

You can reserve your hotels directly using the RAI's online reservation system (via booking.com). Just enter your arrival and departure dates and make your choice from a wide selection of hotels. We advise you to book as soon as possible so we can guarantee the finest accommodation at affordable rates. See the website for details

CONTACT US

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Email: andrew.boakes@ukimediaevents.com
Tel: +44 1306 743744

THE EXHIBITION – 80+ EXHIBITORS EXPECTED!

Autonomous Vehicle TECHNOLOGY WORLD EXPO 2018

5, 6, 7 JUNE 2018, MESSE STUTTGART, GERMANY

If you are working on an autonomous vehicle project, you need to attend this event!

Your pass includes entry to the exhibition featuring autonomous vehicle design, technologies, development and validation


© Continental

The **Autonomous Vehicle Technology World Expo** encompasses three conferences that are dedicated to autonomous vehicle design, engineering, possibilities and validation. The event features a number of unique exhibits from pioneering companies who are focused on autonomous vehicle technologies, and is held alongside Automotive Testing Expo Europe, Automotive Interiors Expo, Engine Expo, and Global Automotive Components and Suppliers Expo, with 800+ exhibits. In short, if you are working on an autonomous vehicle project, you need to attend this event.

Autonomous Vehicle TEST & DEVELOPMENT Symposium Europe | Autonomous Vehicle INTERIOR DESIGN & TECHNOLOGY SYMPOSIUM EUROPE | Autonomous Vehicle SOFTWARE SYMPOSIUM

www.autonomousvehicletechnologyworldexpo.com

LOOK WHO IS EXHIBITING...

COMPANIES INCLUDE:

AB Dynamics, adasiit, ALL4TEC, SPARK Orn arbor usa, Anritsu envision:ensure, atlatec, zone, b-plus, BLACKDUCK by SYNOPSYS, CEPTON, Chronocam, MORE Automotive, CrowdFlower, CRYSTAL, CTAG, DATASPEED Inc., DEKRA, DIBOTICS, dSPACE, EBV Elektronik, Elektrobit, esi get it right, ETAS, EUROTECH, Foretellix, Fusion Processing, gestigon a Valeo brand, HELIX Technologies Ltd, MIRA, iMAR Navigation & Control, INTEMPORA, kainos, Mechanical Simulation, Mentor Automotive, Mighty AI, MSC Software, National Instruments, NAVENTIK, NIRA Dynamics, TOPCON, OKTAL Simulation in Motion, OPAL-RT Technologies, OPTIS, OXTS Inertial+GNSS, ADAS Groupement, PopcornSAR, PTV GROUP the mind of movement, QTronic Virtual ECUs, VBOX Racelogic, rFpro, SBG Systems, SIEMENS Ingenuity for life, SIGRA, Solid Sands, SPIRENT, tass International A Siemens Business, TESIS DYNAware, TÜV SÜD, VECTOR, VECTORZERO, Velodyne LiDAR, VSI Labs, XENOMATIX Automotive Vision Solutions, Xylon, ZURAGON, NEXT LIMIT, NVIDIA Workshop Partner

VISIT THE WEBSITE FOR THE LATEST *UPDATES*

www.autonomousvehicletechnologyworldexpo.com

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