

Autonomous Vehicle TEST & DEVELOPMENT Symposium

BRINGING TOGETHER THE WORLD'S LEADING ENGINEERS IN THE FIELD OF
AUTONOMOUS VEHICLE RESEARCH, TESTING, VALIDATION AND DEVELOPMENT

OCTOBER 22, 23, 24, 2019

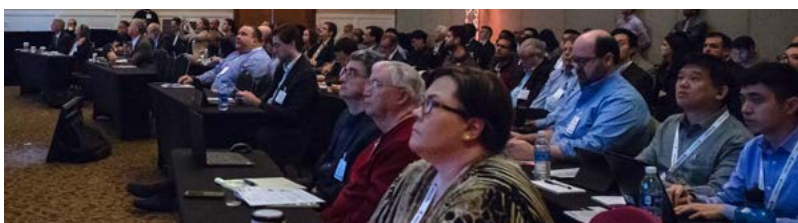
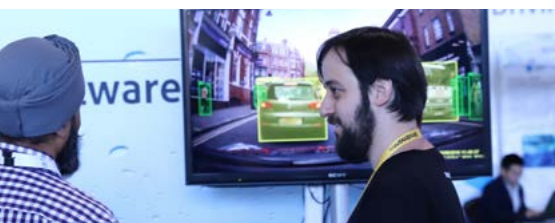
THE SUBURBAN COLLECTION SHOWPLACE, NOVI, MICHIGAN



See full speaker line-up online!



PROGRAM



Held alongside:

Autonomous Vehicle
**TECHNOLOGY
EXPO 2019**
Novi - Michigan

automotive
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North America's ONLY International Conference Exclusively Dedicated to Testing, Validation and Reliability of ADAS, Autonomous Vehicle Technology and Highly Automated Vehicles

Welcome to the
Autonomous Vehicle
Test & Development
Symposium, Novi, Michigan
2019!

The pages that follow
outline the next three days of
presentations. Please take time
to read through the program and
plan your time accordingly, as
we have fantastic content from
more than 50 of the world's
leading experts working in the
field of autonomous vehicle
research, testing, validation and
development. We have added
a second room this year, so
do check the location of your
chosen stream.

Your delegate pass also gives

you free access to Autonomous
Vehicle Technology Expo in the
main exhibition hall. If required,
additional conference passes
for your colleagues can be
purchased at the registration
area in the main entrance foyer.
All conference proceedings will
be made available exclusively
to delegates and speakers after
the event, through our online
web portal. This is a password-
protected system, so please
look out for your login details,
which will be sent to you via
email. Proceedings should be
available by the beginning of
next week.

The team and I are available
to answer any of your

questions regarding this year's
symposium. You will find us and
our technician in the speaker
room, adjacent to the conference
rooms.

And finally, if you are
interested in speaking at next
year's event, do feel free to
discuss this with me. In the
meantime, please sit back and
enjoy the conference. We very
much hope to see you back here
again in 2020 from October
27-29.

Enjoy the conference!

Tim Sandford
Conference director

October 22 & 23

LUNCHTIME WORKSHOP

Presented by

MSC Software

Workshop room adjacent to Room B
12:40pm - 1:50pm

**SOTIF-Based Scenario Hazard Analysis,
Parameterization and Population Specification**

The workshop is open to delegates only and is
pre-registered. Check with conference staff on-site for any remaining spaces.

slido – be part of the conversation!

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we'll be using a simple audience interaction platform called Slido

It's really easy to take part:

- 1) Take out your smartphone and open the web browser
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- 3) Freely submit questions throughout the session



DAY 1 Tuesday, October 22

8:15am - Networking breakfast

8:50am - 12:30pm

Keynote Session - Room A

MODERATOR:

Paul Krutko, president and CEO, Ann Arbor SPARK, USA

8:50am - American Center for Mobility introduction and conference welcome

Paul Krutko, president and CEO, Ann Arbor SPARK, USA

9am - Development of safety testing for automated driving systems

Michelle Chaka, program director, Virginia Tech Transportation Institute, USA

Industry, government and other stakeholders are all working toward the common goal of saving lives and improving mobility through the use of safe, robust, reliable automated driving systems (ADS). Deployments of ADS are currently underway. However, safety testing for ADS is lacking for numerous reasons, including the facts that ubiquitous deployment is years away, the technology continues to evolve, the development is highly competitive and operational driving domains vary. The elements to realize safety testing, which could be widely accepted, are within reach. This presentation explores the various considerations involved in advancing the development of safety testing for ADS.

9:30am - Safety First for Automated Driving (SaFAD)

Neil Garbacik, ADAS system safety and security - systems and components - electrical engineering, FCA US LLC, USA

Through this collective work, we define 12 guiding principles of safe automated driving development for SAE Level 3 and Level 4 automated driving systems, derived from a comprehensive collection of publications and recommendations from public authorities and consumer associations. The work expands to apply the principles to the development lifecycle of automated driving technology, covering requirements development through verification and validation and continuing beyond product deployment. The guidance provided in the paper defines a base framework to initiate industry alignment on developing a safe automated driving vehicle, benefiting everyone from startups to OEMs.

10am - Automated vehicles working together with CARMA3

Dr Taylor Lochrane, technical program manager, USDOT Federal Highway Administration, USA
Cooperative Driving Automation (CDA) supports and enables automated vehicles to cooperate through communication between vehicles, infrastructure devices capable of communication, and road users such as pedestrians, bicyclists and scooter riders. The Federal Highway Administration (FHWA) developed the CARMA Platform and

CARMA Cloud to support the research and development of CDA features in support of transportation systems management and operations (TSMO). The CARMA Platform enables cooperative research functionality to an automated driving system (ADS), and CARMA Cloud enables the roadway to provide information to support and enable safe operation for new TSMO strategies. Developed to be vehicle and technology agnostic, CARMA was designed using open-source software (OSS) and an agile software development process. The latest version of CARMA is available on GitHub and open for collaboration. As FHWA highlights the latest version of CARMA (CARMA3) and collaboration opportunities, learn how CARMA will transform transportation, improving efficiency and safety through automated vehicles working together.



10:30am - Break

11am - Toward safe and socially acceptable autonomous vehicles

Dr Liam Pedersen, deputy director - robotics, Alliance Innovation Lab - Silicon Valley, USA

In the future, autonomous vehicles must not only aim to be safe, but also behave in a socially appropriate manner to be accepted in our society. In fact, safety and social acceptability are tightly linked, as inappropriate or unpredictable behaviors on the part of a car will engender potentially unsafe actions by other road users. This presentation will outline the use of collective human and machine intelligences to solve these difficult problems.

11:30am - Secure, trusted and scalable platform to accelerate AV test and development

Mitra Sinha, autonomous development lead, Microsoft Azure, USA

Autonomous driving is fundamentally transforming the transportation industry, with computer vision, AI and HPC leading the change. The data streams generated by autonomous vehicles are unprecedented, resulting in the need for massive scale across the entire workflow: from PB-scale data ingest and storage to end-to-end algorithm validation, simulation and training. In this session we will show how a hyper-scale public cloud like Microsoft Azure can provide a secure, trusted and scalable platform to help auto makers scale their validation and training jobs and gain development process efficiencies for faster time-to-market.

12pm - Verification and validation to ensure safety first for automated driving

Dr Oliver Rumpf-Steppat, head of department, product requirements, development and connected drive, BMW of North America, USA

This presentation addresses the verification and validation (V&V) of automated driving systems, including field monitoring and updates. It introduces the main steps and general approach, and defines the scope. It continues with an overview of the five key challenges that make V&V unique to L3 and higher automated driving systems. Solutions are proposed for each of the challenges and include a discussion of the various test platforms involved. The presentation also



includes a discussion about the quantity and quality of real-world driving required and the use of simulation for V&V. Finally, the presentation focuses on specific V&V considerations for individual elements of an automated driving system. Although this presentation recognizes the possibility that validation testing may trigger functional design changes, most of it focuses on validating a stable system in a fixed ODD. However, it discusses post-deployment field operations, including the monitoring and management of configuration and ODD changes and updates.

the industry can generate well-understood, comparable, communicable metrics. These metrics are the first steps toward quantifying the safety of autonomous vehicles.

3pm - Practical validation of AI within the SOTIF framework

Dr Edward Schwalb, lead scientist, MSC Software, USA

Whereas control on individual outcomes for autonomous vehicles is limited, engineering processes must exert control over the continuous improvement of overall performance statistics. The ISO/PAS 21448 SOTIF standard partitions scenarios into safe vs. unsafe, known vs. unknown, and recommends continuous improvement to maximize the portion of known safe scenarios at the expense of the other partitions. The required quantitative analysis is performed by combining residual risk analysis, hazard modeling and Bayesian probabilistic reasoning to encompass multiple agents. We detail methods for modeling hazards and leverage those models within a driving loop in which perception algorithms are trained to detect hazards, and the decision logic actively avoids accidents. Finally, we show how to perform engineering against unknown scenarios quantitatively, and to discriminate incremental improvements from regression.

12:30pm - Lunch

2pm - 5pm Test, Development and Validation – Innovations and Best Practices to Ensure Safety - Room A

MODERATOR:

Paul Krutko, president and CEO, Ann Arbor SPARK, USA

2pm - An open, transparent, industry-driven approach to AV safety

Jack Weast, senior principal engineer, Intel & VP autonomous vehicle standards, Mobileye, Intel Corporation, USA

At Intel and Mobileye, saving lives drives us. Since joining forces, we've spread the word on the need for a safety standard for autonomous vehicles (AV), and how consumers and regulators alike demand transparency not offered by existing metrics used in AV safety claims. We proposed Responsibility-Sensitive Safety as a potential solution, a formal, mathematical model that defines what safe driving looks like. It was our first step toward building consensus in the industry. Today we take the next step in that journey, diving deeper into the makeup of RSS: what is this model, how does it work under the hood, and how can RSS help us balance the trade-off between the safety and usefulness of AVs? Higher levels of safety may result in overly conservative AVs that nobody wants on the road. So where should industry and the public draw the line to answer the question, "How safe is safe enough"? Help us drive the conversation today that will enable the autonomous tomorrow.

2:30pm - Realizing measurable safety using scenarios and coverage-driven verification

Yoav Hollander, founder and CTO, Foretellix Ltd, Israel

In this presentation, Yoav Hollander describes an approach to address the largest barrier to the broad deployment of autonomous vehicles: measurable safety. It is now common practice to use scenarios as one of the main ways to ensure AV safety. The presentation will emphasize the need for scenarios to be portable across the various execution platforms used (test tracks, specific simulators, etc), the various stakeholders (OEMs, subsystem creators, regulators, etc), various use modes (fully random and deterministic) and so on. It will also discuss how coverage and grading metrics play a crucial role in defining scenarios, evaluating the results and ensuring safety. Coverage-driven verification offers a revolutionary approach, shifting the industry from looking at the number of miles driven to test AVs, to using a new measure – quality of coverage. With this new measure,

3:30pm - Break

4pm - Panel Discussion: Setting the standards for safety testing and development

How can the industry best take safety to the next level? Is a collaborative approach to testing and development the best solution?

MODERATOR:

Paul Krutko, president and CEO, Ann Arbor SPARK

Neil Garbacik, ADAS system safety and security - systems and components - electrical engineering, FCA US LLC, USA



Yoav Hollander, founder and CTO, Foretellix Ltd, Israel



David Woessner, executive vice president of corporate development and regulatory affairs, LM Industries, USA



Dr Taylor Lochrane, technical program manager, USDOT Federal Highway Administration, USA



2pm - 3:30pm Mapping and Positioning - Room B

MODERATOR:

Dr Sherin Abdelhamid, Technical Advisor Autonomous Vehicle Innovation Network - Ontario Centres of Excellence, Canada

2pm - Characterization of GNSS and map accuracy for automated vehicles

Curtis Hay, technical fellow, General Motors, USA

For safe and reliable operation, automated vehicles require intelligent fusion of many different sensors. These include camera, radar, lidar, GNSS, inertial measurements and a high-definition map. GNSS and map accuracy must be characterized to ensure these inputs are trustworthy. This presentation describes some of the key attributes that must be measured before these inputs can be provided to the vehicle sensor fusion controller.

2:30pm - Integrity for high-accuracy GNSS applications: RTCM SC-134 multimodal approach

Roberto Capua, Responsible for GNSS R&D, RTCM SC-134 Chairman and BoD Member

The presentation will cover: RTCM organization overview and historical background of high-accuracy GNSS; the state of the art in high-accuracy and high-integrity GNSS; the scope of the RTCM SC-134 and working groups; safety requirements

and challenges related to autonomous transport applications; a multimodal approach for the standardization and regulation of high-accuracy and high-integrity navigation applications (road, rail, mapping); GNSS systems evolutions and Galileo; conclusions and next steps.

3pm - Solving the vehicle positioning problem

Jeremy Bennington, solutions and technical strategy lead, Spirent Communications, UK

Dr Alain Vouffo, product manager - automotive, Spirent Communications, France

Considerable effort has gone into determining the relative position of a vehicle in relation to its surroundings. However, there is still a need to know the absolute position of the vehicle for navigation and V2X. Several technologies including global navigation satellite systems (GNSS) can be used, as well as HD maps. Although GNSS has become increasingly accurate and reliable, it cannot solve the positioning problem in all cases. Similarly, other approaches can't be used in all cases due to environmental factors and availability. This session will discuss the criticality of positioning fusion for V2X and navigation.



3:30pm Break - Conference continues at 4pm – please join the panel discussion in Room A

DAY 2 Wednesday, October 23

9am - 5pm Solving Complex Challenges – Simulation, High-Performance Computing, Testing Software and AI - Room A

MODERATOR:

Dr Edward Schwalb, lead scientist, MSC Software, USA

9am - A massive simulation approach to verify and validate AV systems

Tony Gioutsos, director portfolio development for autonomous Americas, Siemens, USA

This presentation discusses a massive validation and verification framework for ADAS and autonomous vehicles. The framework combines data management, test automation and results post-processing capabilities into a seamless workflow. For the execution, highly accurate simulation solutions are coupled to model the vehicle, the sensors and the environment, with the opportunity to exchange component models with different fidelity levels, depending

on the exact test case. By coupling results to requirements and back, the approach allows for detailed analysis of AV systems. Cloud or cluster processing is also discussed, as well as coupling to real-world test tracks.

9:30am - Challenges of deep learning in the automotive industry

John Manera, field automotive CTO, Dell EMC, USA

Larry Vivolo, senior business development manager - automotive and EDA, Dell EMC, USA

After briefly introducing deep learning, the talk will focus on the common workflow of constructing a neural network in terms of the lifecycle of automotive product development: the data collection and acquisition phase, data annotation phase, quality checks and finally constructing the network with its test and validation as a last step. The audience will understand the common workflow and the basics of constructing a deep-learning-based classifier for automotive product development; become aware of typical challenges/problems and how to avoid and counter them; learn how to test and validate deep-learning-based algorithms for autonomous driving; and understand how many miles must be driven, how many images annotated, and the massive investment needed in terms of effort for test and validation.



10am - Bringing accuracy to autonomous vehicles simulation with high-fidelity physics

Dr Sandeep Sovani, global director, automotive industry, Ansys Inc, USA

This talk will provide insights into high-fidelity physics-based simulation methods used in autonomous vehicles to drive scenario simulation as well as detailed component development. In particular, light simulation for optical sensors (camera, lidar) and electromagnetics simulation for radar will be discussed. Additionally, reduced order models (ROMs) and modeling methods will be presented. ROMs are used for expediting simulation beyond real time, while maintaining a high degree of physical accuracy. Finally, driving scenario simulation with physically accurate sensor models will be presented. Examples of typical corner cases that can only be addressed with high-fidelity physics-based simulation will be shown.

10:30am - Break

11am - Automating simulation for safer self-driving

Ferenc Pintér, aiSim product manager, Almotive, Hungary

The presentation details how automated simulation testing can accelerate the development of automated driving solutions, while making them safer. The importance of simulation is showcased by examining points of interest in Almotive's development pipeline. First, while detailing the demands of simulation for autonomous driving, the need for a comprehensive content library is stressed. Second, the uses and limitations of simulated training data for neural networks are touched upon, followed by how scenarios should be defined based on real-world situations, alongside functional safety engineering. Finally, two case studies provide insight into how simulation has solved problems in Almotive's internal development efforts.

11:30am - Scenario-based virtual validation of AVs

Dr Henning Lategahn, CEO, Atlatec GmbH, Germany

Waymo, Cruise and Zoox lead the pack in autonomous driving by some standards. The one thing they have in common is the heavy use of simulations in which real-world data is processed, and extracted scenario descriptions are fed into a simulator. The simulator replays these scenarios time and time again, leading to a quantum leap in training

the underlying AI. We present a way to extract a high-fidelity road model and traffic scenarios from real-world data. This scenario description can thereafter be used in ADAS simulators such as CarMaker, PreScan, Virtual Test Drive and more, and we thereby contribute to a vast scenario-based virtual validation strategy.

12pm - The AV test fleet of the future is virtual

Norm Marks, Nvidia, USA

Simulation has proved to be essential for safely testing and validating self-driving technology before it's deployed on the road. This presentation will delve into existing simulation challenges and why the industry needs a better solution to test and validate AVs than what has been previously available. Learn how to build a unique virtual AV test fleet in the cloud, and utilize an open, scalable, bit accurate, hardware-in-the-loop solution that will allow the development and validation of AVs without putting others on the road in harm's way. This ultimately enables greater efficiency, cost-effectiveness and safety than what is physically possible to achieve with real-world test drives.

12:30pm - Lunch

2pm - Scenario-driven development 2.0

Philipp Renner, technical sales manager, Understand.ai, Germany

Given its complexity, the testing of Level 3 and 4 highly automated driving has become the bottleneck. The old paradigm of mileage-driven testing will need to be replaced by scenario-based testing to test autonomous vehicles in a measurable, consistent and deterministic way. The new paradigm – scenario-driven development – is most efficient when adopted early in the process of design and development of HAD. In this presentation we define scenarios and explain why they are important. We illustrate at what points scenarios create value in the value chain of autonomous vehicle design and deployment. We also present our pipeline for scenarios.

2:30pm - Virtual validation and simulation at large scale, for training, testing and deploying automated driving systems

Heikki Laine, VP product and marketing, Cognata Ltd, USA

Machine learning and deep neural networks require tremendous quantities of data for training and validation, but even at scale, raw, repetitive or inaccurately labeled data doesn't produce results. Training and validation call

NETWORKING PARTY!

WEDNESDAY
OCTOBER 23,
2019

Line-up will include stand-up from Jim Tavaré, drinks party, three simultaneous aerial acts, plus dinner followed by a quiz and live-fun casino!

for accurate, large-scale data sets comprising common scenarios, edge cases and every sort of variation in between. Furthermore, each process requires a distinct data set. We will explore how new techniques in synthetic data generation are helping time-pressured industries like automated driving satisfy the ever-growing need for larger, more diverse and highly accurate data sets.

3pm - Autonomous vehicles: automation of training, simulation and perception detection using high-performance computing

Srijani Dey, chief architect, Americas Analytics Center of Excellence lead, DXC Technology, USA

This session will explore hyperscaling with data and a compute platform to sustain the increasing data ingestion with SLAs and KPIs and enable data access in different formats with increasing performance for scenario detection, tagging and labeling. Additionally, we will look at the automation capability of the platform and the handling of containerized workloads.



3:30pm - Break

4pm - Panel Discussion: Bridging the gap – simulation frameworks and real-world validation methodologies

Simulation is a pivotal enabler for the development of automated vehicles within reasonable timelines. This panel will provide an overview of current methodologies and recent advancements in simulation as well as approaches to validate simulated results with real-world results. Toolchains and pipelines for scene and scenario generation (both creation and extraction) will also be presented. Multi-fidelity simulation (full sensor vs. object level) and its relationship to scene design will be discussed. Standards and regulation programs and adoption rates will also be touched on throughout the panel.

MODERATOR:

Daniel Schambach, co-founder/head of design, Metamoto Inc

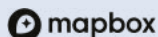
Steve Rotenberg, CEO, VectorZero, USA



Jace Allen, business development manager - simulation, test and EEDM, dSPACE Inc, USA



Natalie Afonina, product lead HD maps, Mapbox, USA



9am - 12:30pm

Vision – Sensors and Lidar Test and Development - Room B

MODERATOR:

Mohammad Musa, co-founder and CEO, Deepen AI, USA

9am - An eye test for your AV: validating your ADAS sensors and ECUs

Vince Socci, business development manager - Americas automotive, National Instruments, USA

Safe autonomous vehicles require clear vision of the world around them. The AV 'eyes' (radars, cameras, lidars, ultrasound, V2X) and 'brain' (ECU, sensor fusion) need a vision test to ensure a clear view of the world. ADAS developments must validate raw sensors, sensor-fusion data, environmental scenarios and driving profiles. This requires the ability to read and simulate sensors, record and play back scenarios, and emulate the environment around the vehicle. The presentation provides an overview of the test challenges and demonstrates a verification approach to satisfy them. The audience will learn a simple workflow to test the complex nature of autonomous vehicle vision.

9:30am - Safety-focused lidar solutions and opportunities in testing and validation

Dr Mircea Gradu, senior vice president quality and validation, Velodyne Lidar, USA

There is a great need for the AV industry to identify lidar requirements and standardize how to address them. The goal is to have lidar products undergo testing and validation based on the standards early in their product lifecycle, with the results made available to auto makers and Tier 1 suppliers. It is necessary to create specialized tests and validation cases that establish standard ways to determine whether lidar sensors can address industry demand. To be of value to auto makers, all lidar sensors need to be assessed by the same gauge.

10am - Building the vision needed to enable autonomous mobility

Jason Eichenholz, co-founder and CTO, Luminar, USA

From early vehicle commercialization in the 1920s to DARPA in the early 2000s, the path to autonomous vehicles has been long and winding. The market has set its sights on a future of self-driving cars, but today's technology still falls short of expectations. The best AV programs today are only improving performance by 50% each year. At that rate – unless there is a dramatic improvement in the technology – self-driving won't be better than humans until 2040. In this presentation, Luminar CTO and co-founder Dr Jason Eichenholz will discuss the requirements for a fully autonomous vehicle, the state of the technology today, and what we need to do to get there.



10:30am - Break



11am - How to validate multi-gigabit sensor data streams

Adrian Bertl, team lead product marketing, b-plus GmbH, Germany

As part of the move to autonomous driving, the validation requirements of automated driving developers will increase. The presentation covers the main technical obstacles dealing with multi-sensorics (covering camera and radar) systems and tool requirements, and gives an insight into best practices to overcome the challenges. The presentation covers the workflow beginning from raw sensor data extraction from imagers, to time synchronization via the recording of multiple sensor data streams, to the ingest into a data center or a cloud.

11:30am - Bringing the power of radar to autonomous driving

Ram Machness, VP of product, Arbe Robotics, USA

While OEMs ramp up Level 2 vehicle production, recent AAA testing shows ADAS are not ready to handle real-world driving. To achieve L2 and higher autonomy, there is a need for a highly advanced sensor to view roads with ultra-high resolution and a wide field of view – in the hope of resolving ambiguities, achieving low false alarm rates and coping with mutual interference. This presentation will explain why imaging radar is the only technology that can overcome industry challenges, and discuss the role radar plays in the future of vehicle autonomy and mobility.

12pm - Designing lidar for automotive test and reliability

Mitch Hourtienne, director of business development, Cepton Technologies Inc, USA

This session will explore best practices for lidar testing and development across a variety of scenarios, including lighting and weather conditions. Attendees will learn about the benefits and drawbacks of different lidar wavelengths and technologies, and how lidar can be used in combination with cameras and radar to provide a safer and more reliable autonomous driving experience. The session will dive into the process of evaluating data generated by lidar, with a candid look at where the technology is today and how it will be further refined as the industry gets closer to bringing autonomous cars to the mass market.

12:30pm - Lunch

October 22 & 23

LUNCHTIME WORKSHOP

Presented by



Workshop room adjacent to Room B

12:40pm - 1:50pm

**SOTIF-Based Scenario Hazard Analysis,
Parameterization and Population Specification**

The workshop is open to delegates only and is pre-registered. Check with conference staff on-site for any remaining spaces.

2pm - 3:30pm Best Practices - Room B

MODERATOR:

Dr Henry Liu, director, Center for Connected and Automated Transportation, USA

2pm - A safety case approach to AV validation with UL 4600

Dr Philip Koopman, co-founder and CTO, Edge Case Research, USA

Validating autonomous vehicles (AV) via brute-force accumulation of miles won't work, whether on the road, test track or even in simulation. Instead, a safety case should be created that includes safety goals, arguments for why those goals are met, and evidence supporting that the goals have been met. Testing according to this approach provides evidence of safety that focuses on specific goals such as validation of system components, models, simulators, design analysis results and system integration properties. The emerging UL 4600 standard provides a framework for organizing this test evidence and ensuring that testing is sufficient to ensure safety without requiring massive brute-force road testing campaigns.

2:30pm - CAV technology systems V&V following NASA's flight systems certification processes

Jim Jolliffe, president, Space Institute Research Corporation (SIRC), USA

The University of Tennessee Space Institute is employing its understanding of NASA's flight systems certification processes for human-rated flight operations to validate and verify CAV technology evaluation methods at its Connected and Automated Vehicle Technology Evaluation Center (CAVTEC). We will present our collaborative approach with examples of recent successes and lessons learned.

3pm - Safe autonomous driving: development of a novel pedestrian target

Dr Igor Doric, executive director, Messring Active Safety GmbH, Germany

This presentation will introduce ASTERO, the latest-generation dynamic pedestrian target, for the first time. Within the TARGETS research project, which was funded by the Federal Ministry of Economic Affairs and Energy (grant number KF2122308DB3), Messring worked in cooperation with CARISSMA, Technische Hochschule Ingolstadt, on the development of a novel pedestrian target. Based on previous research results, ASTERO is now focused on realistic human motion while providing the required robustness and usability for AEB tests on proving grounds. The presentation will also include the 6D Target Mover test system, which is currently installed on a proving ground in Germany.

 **3:30pm - Break** - Conference continues at 4pm – please join the panel discussion in Room A

Day 3 Thursday, October 24

9am - 10:30am Validation in the Virtual Domain - Room A

MODERATOR:

Vivek Jaikamal, business development manager, AVL
Test Systems Inc, USA

9am - Validation of autonomous safety in the context of SOTIF

Jace Allen, business development manager –
simulation, test and EEDM, dSPACE Inc, USA

For the validation of functional safety for automotive E/E systems and embedded software, proper workflows and virtual test methods are necessary. The need for virtual testing and efficient collaboration is increasing because of new challenges with the development of advanced driver assistance systems (ADAS) and autonomous driving (AD). Also, the requirements for a reliable virtual testing process are increasing as ADAS/AD systems are becoming more safety critical. The presentation outlines necessary V&V strategies that are compliant with ISO 26262 and ISO/PAS 21448 to ensure the proper functionality and safety goals of ADAS/AD systems.

9:30am - Automating autonomous vehicle requirements development and validation

Rick Sturgeon, senior director, transportation and
mobility, Dassault Systèmes, USA

The validation process for autonomous vehicle embedded systems faces a serious challenge: the vehicle makes decisions in very unpredictable environments, which means the level of testing must be very high. As test objectives are derived from the functional requirements written using natural language, each and every functional test must be created manually, which greatly reduces the level of confidence necessary for an autonomous vehicle. With Dassault Systèmes' STIMULUS, users are able to simulate, debug and validate the requirement first and then automatically test the actual system against its functional specification, using a large number of tests generated automatically.

10am - Making machine perception real with high-fidelity synthetic data

Victor Gonzalez, CEO, Anyverse (Next Limit SL),
Spain

Training self-driving technology is a crucial step in autonomous vehicle development and deployment, especially in terms of the much-scrutinized safety issue. Unfortunately, this part of the process is still facing a major data challenge. The real-world approach has proved to be insufficient and time-consuming, slowing down the progress and exposing it to numerous loopholes. An alternative solution is the use of virtual images that meet specific training and testing needs and complement real-world data. However, synthetic data is not made equal. It needs to be as real and physically accurate as possible, and include all segmentation data. This is Anyverse.

10:30am - Break

11am - 12:30pm Data and Connectivity. Testing AV Performance - Room A

MODERATOR:

Vivek Jaikamal, business development manager, AVL
Test Systems Inc, USA

11am - Chassis dynamometer testing methodology development for CAV energy consumption

Kevin Stutenberg, principal research engineer,
Argonne National Laboratory, USA

As connected and automated vehicle (CAV) technologies begin to contribute to a greater share of vehicle miles traveled, methods for evaluation of these systems must advance to accurately quantify their impact. Chassis dynamometers have long been a standard for vehicle testing and development activities, in particular for the evaluation of energy use, fuel consumption and criteria emissions, providing an environment in which a vehicle may be tested in safe, variable, controllable and repeatable conditions with flexible instrumentation. The focus of this work will be on the development of methods for the characterization of CAV behavior and impact on vehicle performance.

11:30am - Motion planning at the physical limits

Dr Stefano Longo, head of automotive, Embotech,
Switzerland

A vehicle's physical capabilities are crucial for the feasibility and smoothness of any maneuver. Traditional motion planning methods for AD neglect most of the physics, being conservative or requiring advanced low-level vehicle controls that are often not present or are prohibitively expensive. We demonstrate physics-based motion planning technology, using numerical optimization, to calculate smooth and safe trajectories that can be easily followed by standard low-level vehicle controllers. Based on recent advances in embedded optimization technology, we capture most of the relevant vehicle dynamics while driving on a highway or on rural roads, significantly extending the performance envelope of autonomous cars.

12pm - "Can't we all just get along?" An approach to ensuring interoperability in V2X hardware

Kimberly Clavin, VP of engineering, Loop by Pillar
(part of Accenture Industry X.O company), USA
Nick Hegemier, managing director of infrastructure,
DriveOhio, USA

Using traditional agile software practices such as test-driven development and continuous integration within a closed-loop ecosystem of V2X hardware, one can validate, in high quantities, the authenticity and accuracy of messages being

tossed between the city and cars as well as between the cars themselves. This talk will demonstrate a case study of work performed at DriveOhio. DriveOhio, together with Pillar, a part of Accenture's Industry X.O, has created a path by which to test the interoperability of hardware equipment within a lab environment. This system allows for application-based test scenarios in an automated fashion. These tests can be run in high-quantity batches, which is a great advantage over driving roads for single data points. In essence, this ecosystem allows for changes in standards and/or technology to be easily tested, and errors rectified quickly.

X 12:30pm - Lunch

2pm - Panel Discussion: Expediting the AV future – the next phase of the Silicon Valley-Detroit relationship

Engineers, analysts, commentators and automotive experts in both Detroit and Silicon Valley agree that the two regions must work together to speed up the development and deployment of autonomous vehicles (AVs). This panel will explore how OEMs and Silicon Valley software companies have been collaborating on the most pressing technical and production-oriented challenges. What are the biggest obstacles facing both sets of companies? When should Silicon Valley companies consider opening Detroit offices and vice versa? What does this collaboration mean for the future of the American automotive industry?

MODERATOR:

Qasar Younis, co-founder and CEO, Applied Intuition Inc

Aditya Srinivasan, general manager, North America, Innoviz Technologies, USA



INN OVIZ
TECHNOLOGIES

Alisyn Malek, COO and co-founder, May Mobility, USA



may
mobility

Mohammad Musa, co-founder and CEO, Deepen AI, USA



deepen

MEDIA PARTNERS



9am - 12:30pm Real World, Mapping and Standards. Innovation in Testing and Development - Room B

MODERATOR:

Roberto Capua, Responsible for GNSS R&D, RTCM SC-134 Chairman and BoD Member

9am - HD maps: dynamic enablers of autonomous driving

Praveen Chandrasekar, regional senior product manager, autonomous driving, TomTom, USA

The path to achieving highly automated driving differs across solutions providers and auto makers, but comfort and safety are a high priority for all. Traditional sensors such as camera, radar and lidar have greatly increased AVs' perception capabilities – but without HD maps, they cannot accurately understand their position on the road and plan their path for the road ahead. Learn why the combination of HD maps and sensors is critical to enabling high-accuracy localization, environment perception and path planning to create a robust autonomous driving experience that will ultimately lead to a safer world, free of congestion and emissions.

9:30am - Turning low-quality data into high-quality map updates

Ethan Sorrelgreen, chief product officer, CARMERA, USA

This presentation will explore how low-quality camera data gathered from high-coverage fleets and global OEM vehicles is continually processed into high-confidence HD map updates. Additionally, the talk will cover how the data gathering and mapmaking are designed around various levels of connectivity and in-vehicle hardware variables.

10am - Certification of autonomous vehicles: inspiration from the rail sector

Dr Ales Filip, associate professor/lecturer/head of research center, University of Pardubice, Czech Republic

Safety is a key driver in the development of autonomous vehicles (AVs). It is currently assumed that the safety of AVs should be approximately at the same level as the safety of trains or airplanes. To guarantee such a high level of safety, it is necessary to have a clearly defined regulatory framework for AV certification. This paper deals with the concept of a regulatory framework for AVs based on the safety authorization process used for train control. The Common Safety Method for Risk Evaluation and Assessment (CSM-RA) is utilized for this purpose. The concept will enable the demonstration and maintenance of such high safety levels as are required in the case of railway signaling (SIL 4).

C 10:30am - Break

OCTOBER 22, 23, 24, 2019

THE SUBURBAN COLLECTION SHOWPLACE, NOVI, MICHIGAN

11am - Testing challenges with autonomous driving – the raw facts

Jeff Warra, director of autonomous platform solutions, Intrepid Control Systems, USA

Helping to address and study the challenges faced by auto makers, suppliers and vehicle researchers, the level of sophisticated debugging and datalogging has never been greater. To properly understand what has happened minutes prior to a disengagement, we must be able to record video data with its detection classifications to ensure we can reconstruct and better understand the events leading up to the disengagement. Being able to record and synchronize multiple data sources like video, CAN-FD and Ethernet will help address these design challenges. Our most precious asset is time, and test tracks are eager to sell you as much of it as you need. But are OEMs, designers and suppliers utilizing this time properly? With the amount of data being generated in a vehicle today, having a solution that addresses the recording and storage challenges will help speed up the pace of development. This presentation will show how to calculate the amount of bandwidth and storage needs when dealing with transmitting a camera's raw images in various pixel formats. Being able to capture raw vision data along with other communication buses like CAN-FD and Ethernet helps engineers properly evaluate developments and disengagements, helping to speed along development with a reliable and robust approach.

11:30am - The future of autonomy – setting the safety expectations for AVs today

David Woessner, executive vice president of corporate development and regulatory affairs, LM Industries, USA

Most automotive companies today are facing the challenges of government regulation and slow legislative change as obstacles to the advancement of safe and secure AV technology. LM Industries' crash testing of its autonomous

shuttles, coupled with co-creation microfactories and continuous government advocacy, are setting the expectations for what a future with autonomous vehicles should look like. This presentation will discuss how crash testing and AV research can be used as effective tools to establish AV safety, and how co-creation allows for smaller communities to be a part of the larger AV conversation in government policy.

12pm - A regulation-compliant safety framework for the approval of automated vehicles for deployment on public roads

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

A general regulation for automated vehicles is currently not available. There are no approved methods for certification or approval. On the other hand, many use cases or initiatives are struggling to operate automated vehicles on public roads. This can be the deployment of test vehicles and prototypes, research prototypes or automated bus shuttles for first/last-mile usage. In some areas (California, Germany), local regulations provide a method for the approval and certification of such vehicles. TÜV Süd developed a universal framework that copes with the heterogeneous local regulations and provides a unified method for the assessment of automated vehicles. This framework considers local roadworthiness regulations as well as functional safety and cybersecurity, and thus can be applied in any region in the world. With this, TÜV Süd has enabled ambitious projects to be successful in operating automated vehicles on public roads, without any incidents or safety issues.



12:30pm - Lunch - Conference continues at 2pm – please join the panel discussion in Room A

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