

Symposium 2021 Breakout Session Title:

B306-ADS Simulation and Testing Part 2: Approaches for Validation and Collaboration

Session Contact/Organizers:

- Shawn Kimmel, Director of Engineering, Quantitative Scientific Solutions (QS-2)
- Jacobo Antona, Automated Vehicle Safety Standardization, Japan
Automobile Research Institute
- Siddhartha Khastgir, WMG, University of Warwick UK
- Ben Engel, ASAM
- Taylor Lochrane, CARMA Program Manager, US DOT FHWA
- Rob Hellman, Director, US DOT Highly Automated System Safety Center of Excellence
- Chris Schwarz, Director of Engineering and Modeling Research, National Advanced Driving Simulator, University of Iowa
- Jiaqi Ma, Associate Professor, UCLA
- Sky Guo, Ph.D. Candidate, Texas A&M

Session Description

ADS simulation and testing is critical to the development and deployment of ADS, but is very resource intensive and the utility of testing results is limited by the ability to validate them. Approaches to collaborative testing and simulation validation can help accelerate ADS and cooperative-ADS development. Collaboration can reduce research and development costs leverage interoperable testing and validation toolchains, common test methods (for software-in-the-loop, hardware-in-the-loop, vehicle-in-the-loop, and on-road), and common scenario databases. This session will explore opportunities to leverage interoperability and distributed testing platforms to advance ADS technology. To build trust in test results from simulation testing methods, effective validation approaches are critical. This session will discuss the data outputs from testing, and how this ties back to test objectives. This answers questions like (1) how to agree on a representative scenario database? and (2) how to validate the simulation environment.

Goals/Objectives/Outputs

- Understand international efforts to create interoperable testing toolchains and bring value, e.g., reducing the cost of development
- Identify opportunities to advance common testing architecture and interfaces, and the impact of ODD
- Identify potential partners to enable your organization's testing goals
- Discuss what constitutes a representative scenario database
- Explore approaches to validating simulation environments

Agenda

(10 mins) Why Simulation? Why Collaborative Simulation?

Description: **What is the opportunity space? When does collaborative RD&T make sense? How does it help reduce costs? How do commonly accepted approaches to V&V and testing completeness support deployment?**

Keynotes:

- Rob Heilman, Director, US DOT Highly Automated Systems Safety Center of Excellence

(70 mins) Co-Simulation and Distributed Testing Platforms for ADS

Description: **Discuss the examples where co-simulation toolchain enables different phases of product lifecycle, including R&D, V&V and benchmarking. What efforts exist to create interoperable and distributed testing toolchains? What elements are needed: Standards, cloud infrastructure, shared scenario libraries and execution, etc. Discuss middlewares, scenario definition files (e.g., OpenScenario 1.0...) and programming languages (e.g., OpenScenario 2.0). How does the test platform requirements change based on the test objectives (e.g., regulatory, safety case, energy efficiency benchmarking).**

Moderator:

- Shawn Kimmel, Ph.D, Director of Engineering, Quantitative Scientific Solutions (QS-2)

Topics and Panelists:

- SafetyPool – Siddhartha Khastgir, Head of Validation and Verification for CAVs, WMG University of Warwick
- SAKURA/SIP Collaborative Approach – Jacobo Antona-Makoshi (AV Vehicle Safety Standardization, Japan Automobile Research Institute) and Satoshi Taniguchi (AV safety assurance, JAMA)
- Open Scenario Libraries - Jaqui Ma, Associate Professor, UCLA
- ASAM OpenX – Ben Engel, Global Technology Manager, ASAM
- USDOT VOICES – Rob Heilman, Director, US DOT Highly Automated Systems Safety Center of Excellence
- Operating Envelope Specification for an ADS Safety Testbed - Dr. Edward R. Griffor, Associate Director, Smart Grid and Cyber Physical Systems Program Office, NIST

(60 mins) Simulation Validation and Representativeness

Description: **Discuss approaches to simulation verification, and use of simulation for validation and accreditation. Discuss how scenario libraries can be representative, and how they support performance benchmarking.**

Moderator:

- Chris Schwarz, Director of Engineering and Modeling Research, National Advanced Driving Simulator, University of Iowa

Topics and Speakers:

- NHTSA's VRTC Simulation Research, Scott Schnelle, NHTSA, VRTC
- EuroNCAP - Matthew Avery, Director of Insurance Research, Thatcham Research

- Validation Lessons Learned from Aerospace – Edward Chow, Manager, Civil Program Office, NASA Jet Propulsion Laboratory
- USDOT CARMA - Philip Azeredo, US DOT VOLPE
- Simulation Toolchain Validation – Jace Allen, Director of ADAS/AD Engineering, dSPACE

(40 mins) Test Case Completeness and Testing Efficiency (Interactive)

Description: **Discuss approaches to tie back smaller subset of scenarios to demonstrate competency in a larger scenario space. How much of the ODD has been covered? How much ODD space needs to be covered? How are concepts like scenario criticality and complexity captured in test plans?**

Interactive breakout sessions facilitated by session organizers with a list of probing questions

Moderators:

- Rob Heilman, Director, US DOT Highly Automated Systems Safety Center of Excellence
- Siddartha Khastgir, Head of Validation and Verification for CAVs, WMG University of Warwick
- Shawn Kimmel, Ph.D, Director of Engineering, Quantitative Scientific Solutions (QS-2)
- Jacobo Antona, Automated Vehicle Safety Standardization, Japan Automobile Research Institute

Related Sessions:

Should be adjacent to - ADS Simulation and Testing Part 1: "What's New?" - coordinating with Chris Schwarz as part of a 2 part session on the same common theme)

Safety Assurance (Scenario Databases)