Development of Industry Standards to support Advanced Driver Assistance Systems, Connected Vehicle and Automated Driving Technologies

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Our Portfolio

PUBLICATIONS
100,000+ collection of technical publications

CONFERENCES
30+ technical conferences worldwide

TECHNICAL STANDARDS
35,000+ aerospace and ground vehicle standards

MEMBERSHIP
145,000+ members worldwide

FOUNDATION
SAE's charitable arm supporting STEM

PROFESSIONAL DEVELOPMENT
Extensive portfolio of courses, webinars

MEDIA
Magazines, *e*Newsletters, Tech Briefs

SAE Global Ground Vehicle Standards in a Nutshell

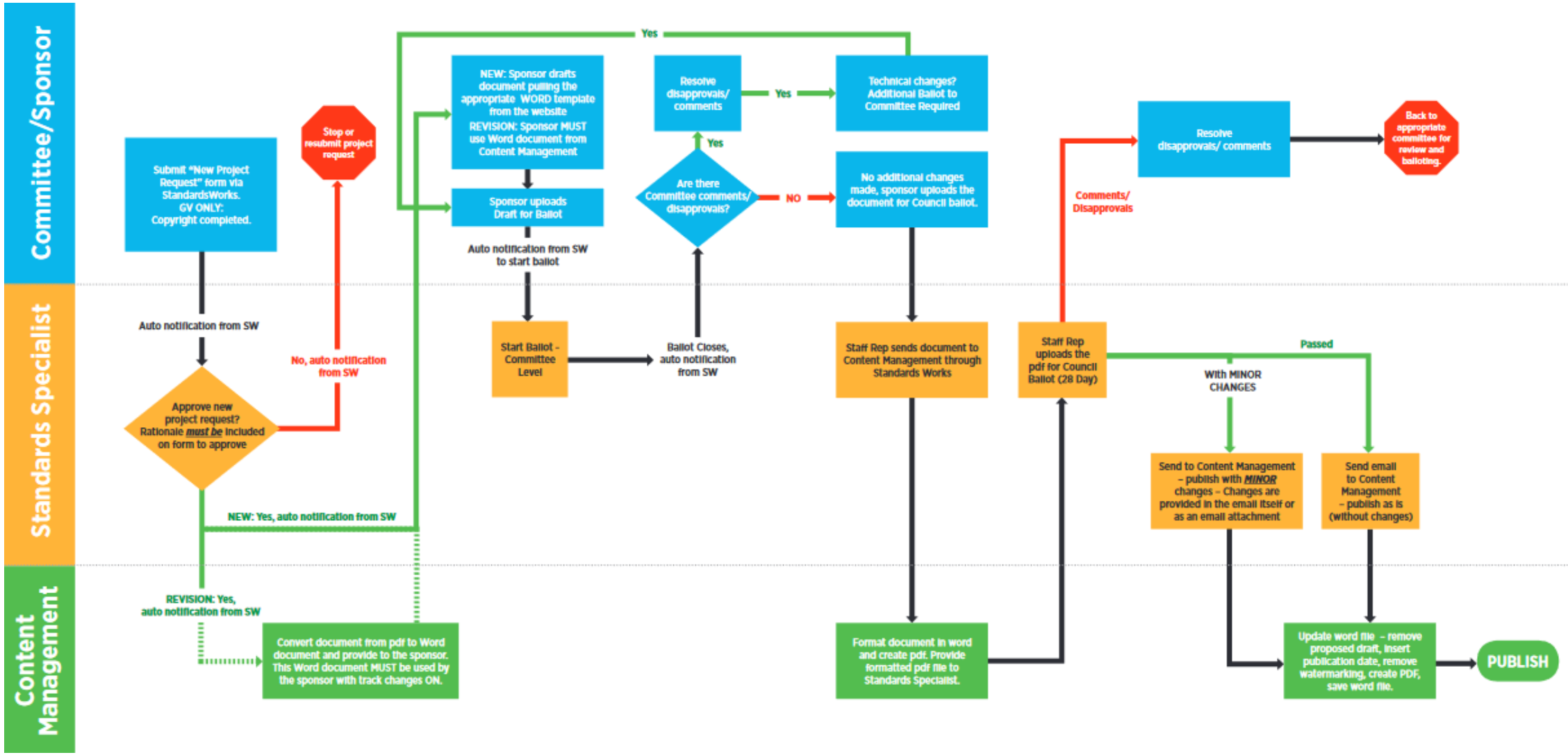
- 8,375 Standards Published
- 1,817 Standards Maintained
- 491 WIP Standards

9,933 Committee Members

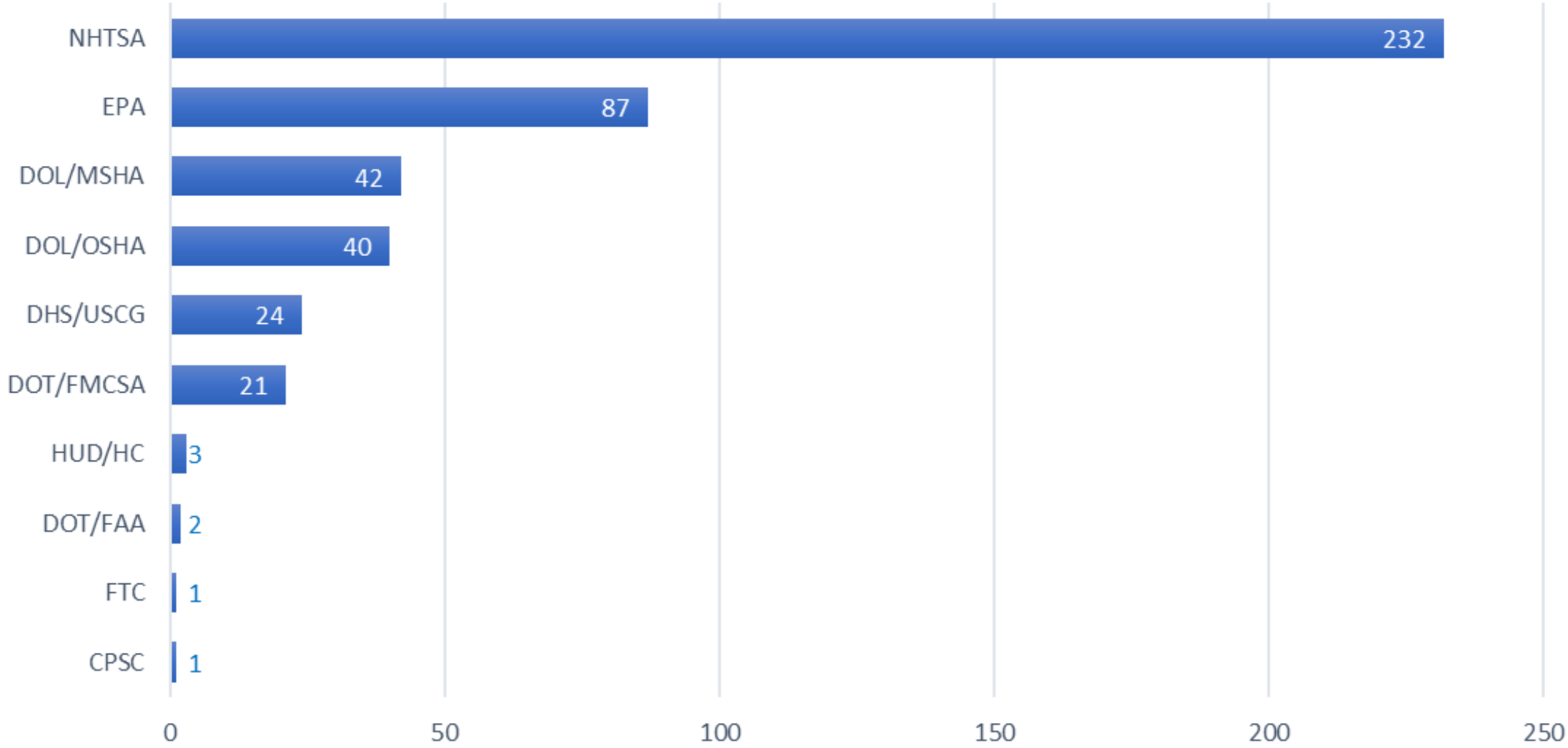
609 Technical Committees

2,898 Companies

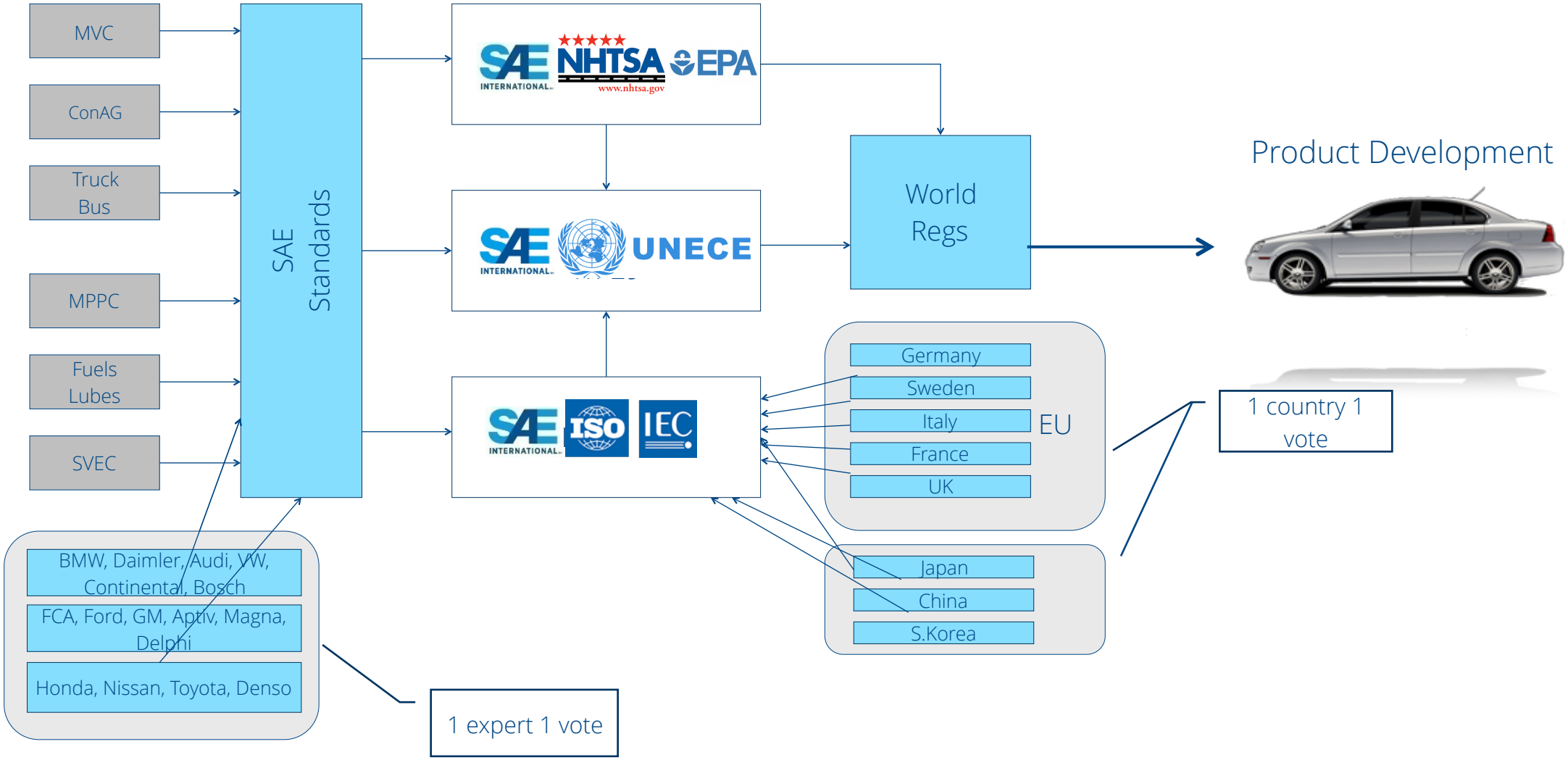
SAE Standards Ballot Process



GV SAE standards cited in U.S. regulations



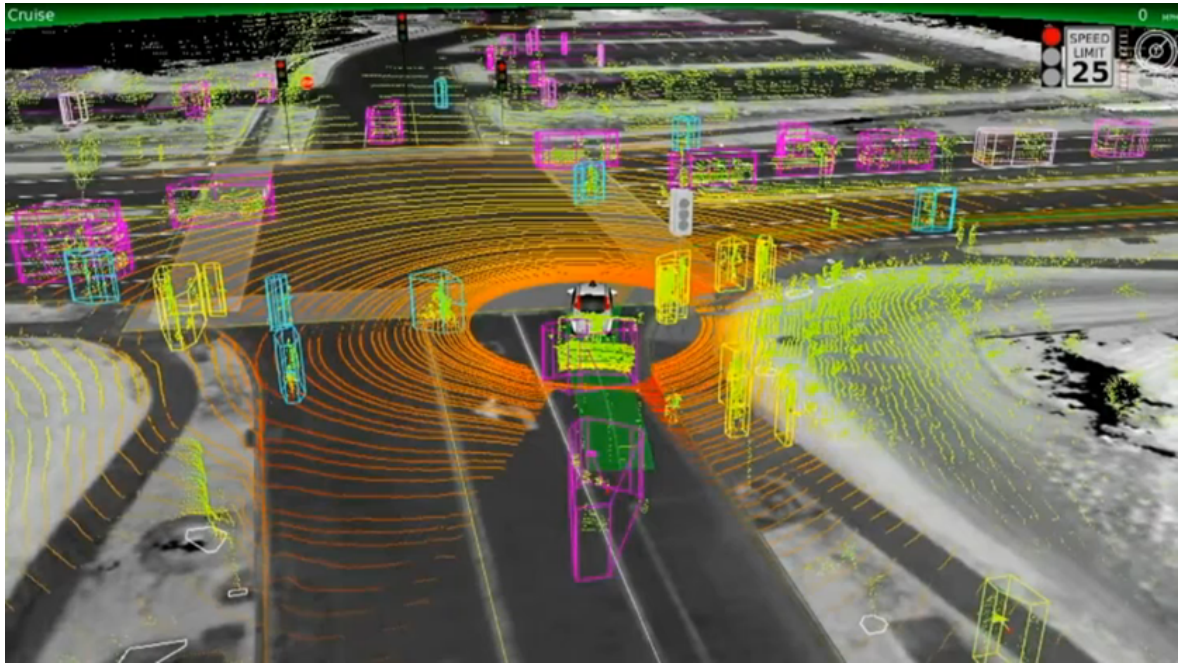
Regulatory and Product Effect of SAE Standards



Define operating design domains for testing

- “Variable” performance testing.
- AV crash data and testing scenarios
- Simulation and physical testing

“Cooperative automation” (FHWA)



SAE Government / Industry meeting: 3-5 April (https://www.sae.org/attend/government-industry)

Key Focus Areas for Standards

J3016 & J3063

J3061 & J3101

SAFETY

J1626/2 & J3092

INTEROPERABILITY

J2735 & J2953

VEHICLE SYSTEM & PERFORMANCE REQUIREMENTS

J2945/1 & J3155

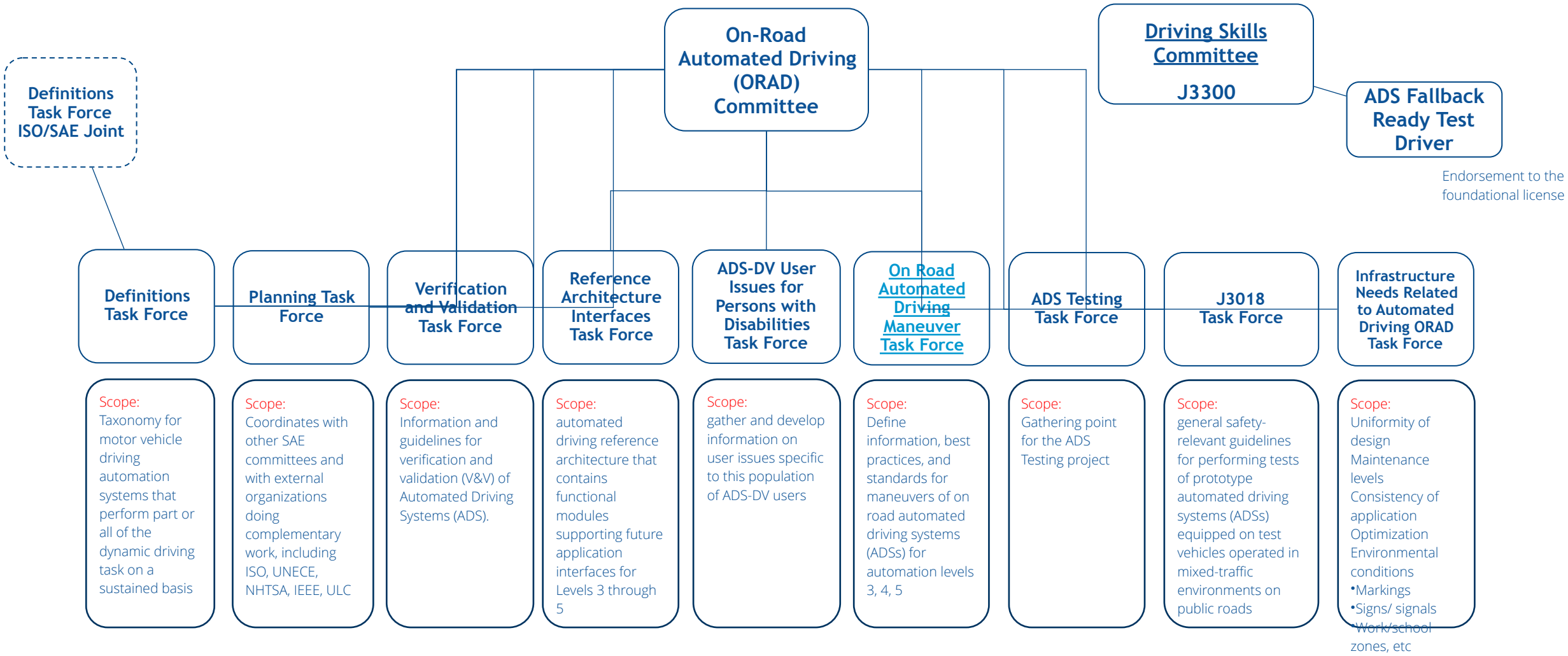
GUIDELINES & RECOMMENDED PRACTICES

J3018 & J3088

TEST & VERIFICATION METHODS

J3045 & J3029

Where SAE automated vehicle standards are developed



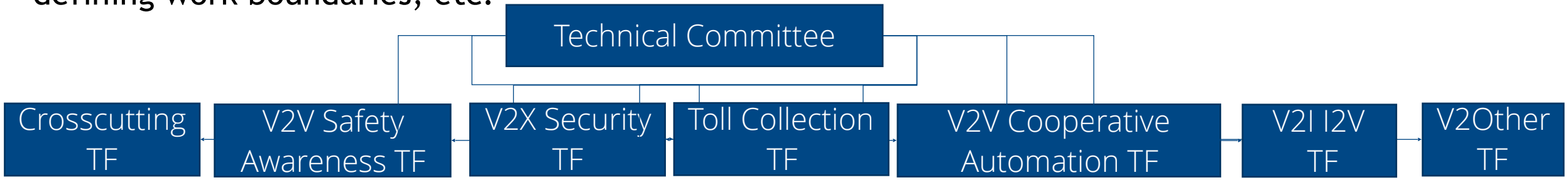
SAE Automation Standards – J3016™

Level	Name	Narrative Definition	DDT		DDT Fallback	ODD
			Sustained lateral & longitudinal vehicle motion control	OEDR		
***Driver* performs part or all of the DDT**						
0	No Driving Automation	The performance by the ***driver*** of the entire *DDT*, even when enhanced by *active safety systems*	Driver	Driver	Driver	N/A
1	Driver Assistance	The *sustained* and *ODD*-specific execution by a *driving automation system* of either the *lateral* or the *longitudinal vehicle motion control* subtask of the DDT (but not both simultaneously) with the expectation that the *driver* performs the remainder of the *DDT*.	Driver and System	Driver	Driver	Limited
2	Partial Driving Automation	The *sustained* and *ODD*-specific execution by a *driving automation system* of both the *lateral* and *longitudinal vehicle motion control* subtasks of the *DDT* with the expectation that the *driver* completes the *OEDR* subtask and *supervises* the *driving automation system*.	**System**	Driver	Driver	Limited
***ADS* ("*System*") performs the entire *DDT* (while engaged)**						
3	Conditional Driving Automation	The *sustained* and *ODD*-specific performance by an *ADS* of the entire DDT with the expectation that the *DDT fallback-ready user* is *receptive* to *ADS*-issued *requests to intervene*, as well as to *DDT performance-relevant system failures* in other *vehicle* systems, and will respond appropriately.	System	**System**	*Fallback-ready user (becomes the driver during fallback)*	Limited
4	High Driving Automation	The *sustained* and *ODD*-specific performance by an *ADS* of the entire *DDT* and *DDT fallback* without any expectation that a *user* will respond to a *request to intervene*.	System	System	**System**	Limited
5	Full Driving Automation	The *sustained* and unconditional (i.e., not *ODD*-specific) performance by an *ADS* of the entire *DDT* and *DDT fallback* without any expectation that a *user* will respond to a *request to intervene*.	System	System	System	**Unlimited**

SAE ORAD Infrastructure Task Force (new)

SAE DSRC Technical Committee (TC) Responsibility & Structure

- Scope: Develop and maintain V2X message set and application standards/recommended practices for interoperability, with short- to medium-range wireless communication protocols
- Concentration of experts group in various Task Forces (approx. 60 members)
- Coordinates with other organizations involved in V2X effort such as related SAE TCs, ETSI, ISO, 5GAA, 3GPP. Activities include maintaining common data dictionary items, organizing initial effort of gathering use cases, defining work boundaries, etc.



SAE DSRC Technical Committee Documents

- Supports interoperability
- Defines standardized message sets
- Defines formats for basic safety message set dictionary
- Being revised to meet new needs/applications

Published

J2735 Message Set Dictionary

- Basic Safety Message (BSM)
- MapData (Map) message
- Signal Phase and Timing (SPaT)
- Personal Safety Message (for pedestrian and other vulnerable road users)
- Traveler Information Message (TIM)

…

- Specifies minimum communication performance requirements
- Defines message transmission rate, channel usage, optional data usage in various situations

Published

J2945/0 Systems Engineering Process Guidance for J2945/x Documents and Common Design Concepts

- System engineering example
- Communication protocol
- Channel use
- V2X message/application priority
- …

Published

J2945/1
On-Board System Requirements for V2V Safety Communications

Published

J2945/9
VRU (V2P) Safety Message Minimum Performance Requirements

J2945/2
Performance Requirements for V2V Safety Awareness

J2945/3 Weather Applications

J2945/4
V2I Road Safety

J2945/5
V2X Security

J2945/6
CACC/Platooning

J2945/7 Positional Improvements

J2945/8
Cooperative Perception

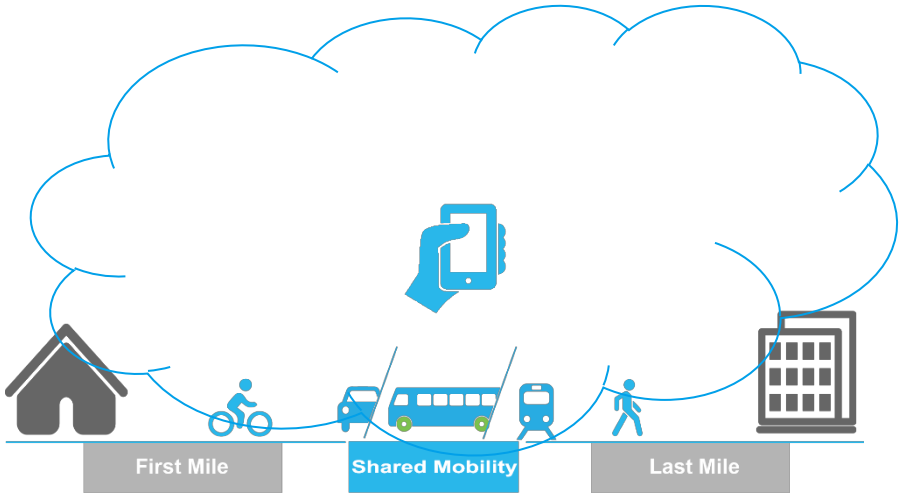
J2945/10
Map/SPaT Related

J2945/11
Signal Preemption

J2945/12
Probe Data

J2945/X
Toll Collection

SAE Shared And Digital Mobility Standards Committee



SAE Shared and Digital Mobility Committee embarked on the task of standardizing terms and definitions related to shared mobility.

MILESTONES

- Established in September 2017
- First technical report:

Published

J3163 – Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies.

It covers six categories of terms related to shared mobility:

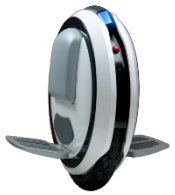
- Symbols and signage for shared mobility
- Data format for data sharing
- Household travel surveys
- Exploring intersect with core GV technologies

SAE Low-Speed Mobility Devices Committee – NEW!

Electric Kick Scooter

Electric Skateboard

(Half) Segways



Electric Self-Balancing Unicycles

Emerging and innovative mobility vehicles and devices, sometimes referred to as micro-mobility, are proliferating in cities around the world.

These technologies have the potential to expand mobility options for a variety of people. Some of these technologies fall outside traditional definitions, standards, and regulations.

This committee will initially focus on low-speed personal mobility devices and the technology and systems that support them that are not normally subject to the United States Federal Motor Vehicle Safety Standards or similar regulations. These may be device-propelled or have propulsion assistance.

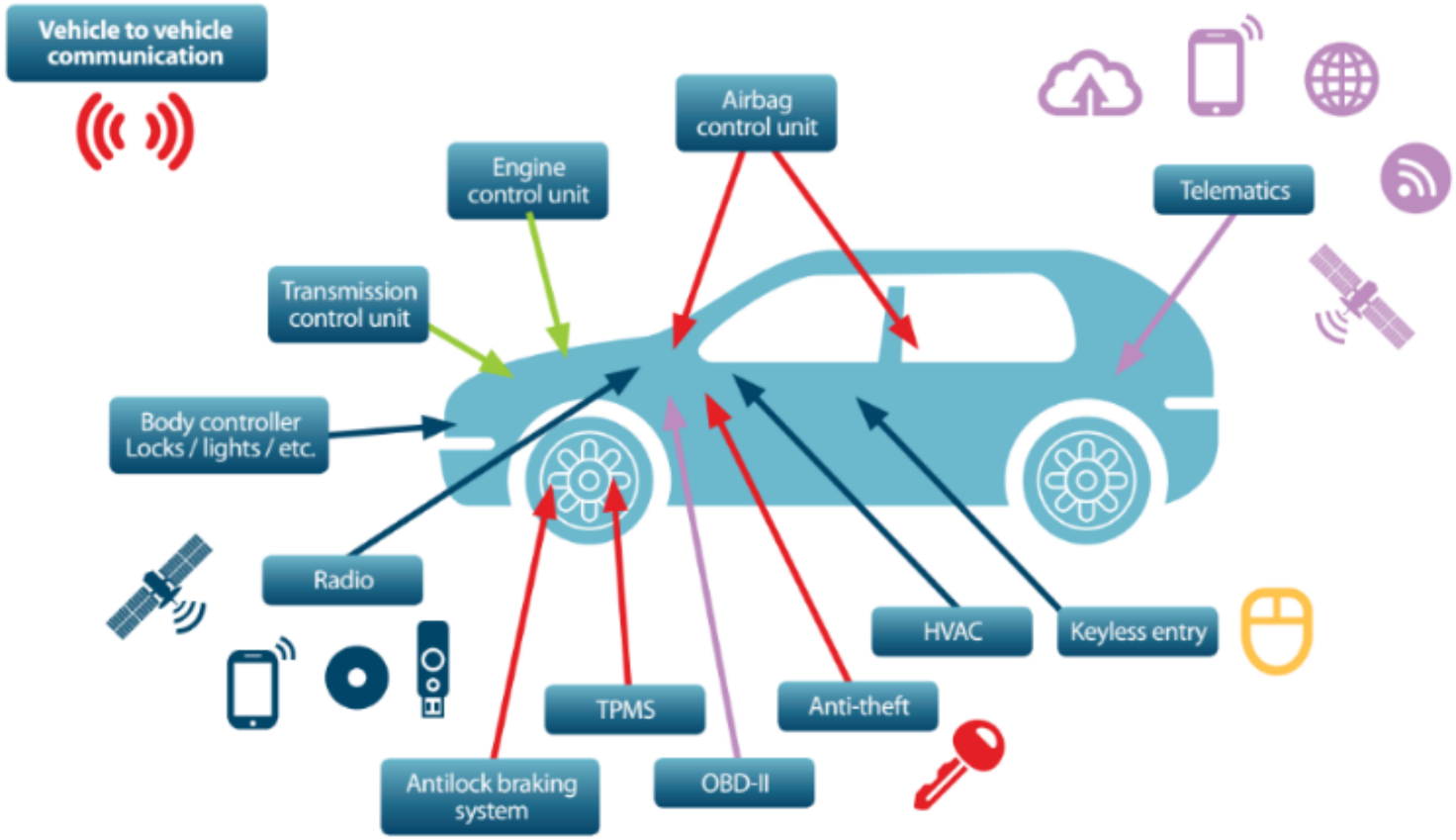
SAE Cyber Security Standards Activities

SAE Vehicle Electrical System Security Committee

- Vehicle Electrical Hardware Security Task Force
- RFC Cybersecurity Task Force

SAE Vehicle Cybersecurity Systems Engineering Committee

- Cybersecurity Assurance Testing Task Force
- Automotive Cybersecurity Integrity Level (ACsIL) Task Force



http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVEES18A1

…but isn't technology moving too fast?

SAE Automated and Connected Vehicle Systems Testing Symposium

- Identifying new paradigms in assessment, testing and validation of connected and automated vehicles
- Partnership with SAE Journal of Automated and Connected Vehicles
  - Editor-in-chief, Venkat Krovi, Michelin Endowed Chair Professor of Vehicle Automation at CU-ICAR

SAE Authored Papers – new SAE Edge Research Report

- Based on submitted Symposium SME discussion papers, presentations and dialogue
  1. Automated Vehicle Deployment Safety
  2. Uncontrolled Environment AV Testing
  3. Controlled Environment AV Testing
  4. Simulated Environment AV Testing
  5. Automated Vehicle Testing Ontology
  6. Automated Vehicle Testing Data Opportunities

June 20-21, 2018 Greenville, SC

SAE International Journal of Connected and Automated Vehicles

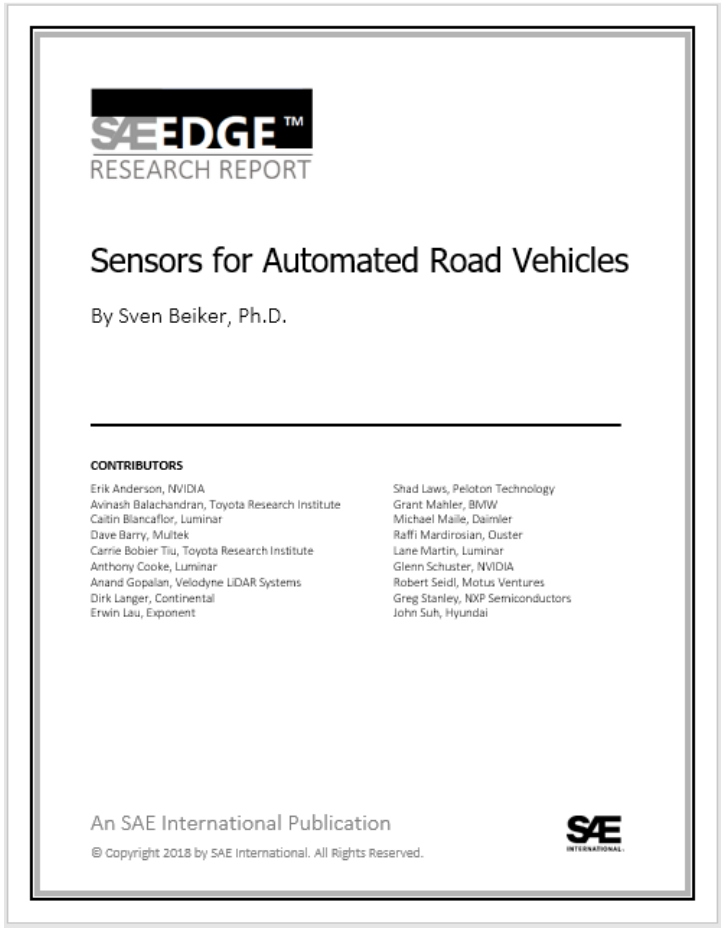
https://saemobilus.sae.org/content/V127-12EJ/

Aims & Scope

Connected and Automated Vehicles: An SAE International Journal furthers the state of the art of engineering research by promoting high-quality theoretical and applied investigations in the arena of connected and autonomous vehicles (CAVs) in on-road, off-road, and aerial operational environments. The enormous growth in numbers, diversity, and complexity of CAVs has been driven by:

- enhancements of fundamental scientific understanding;
- technological convergence of computing, communication, and miniaturization; and
- increased scale and complexity of tangible embodiments and engineering implementations at the component-, subsystem-, and system-levels.

SAE EDGE™ RESEARCH REPORT


SAE EDGE™
RESEARCH REPORT

Sensors for Automated Road Vehicles

By Sven Beiker, Ph.D.

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John Suh, Hyundai

An SAE International Publication

June 28 Launch Subject Matter Expert Workshop

- Facilitated by Sven Beiker, Silicon Valley-based consultant
  - Former Executive Director, CARS
  - Former Senior Manager, BMW

Contributions from 18 industry sensor experts

Topics identified

- Taxonomy for Sensor Data Layers
- Testing, Simulation, Calibration of Sensors
- Security, Robustness, Integrity of Sensors
- Outlook, Date Security and Privacy

Participating Organizations:

BMW
Continental
Daimler
Exponent
Hyundai
Luminar
Motus Venture
Multek
NXP Semiconductors
NVIDIA
Ouster
Peloton
Toyota Research
Velodyne

SAE AutoDrive Challenge – Preparing the next generation of engineers

1. Build formal ***workforce development*** connections between industry and academia.
2. **Establish an integrated standards-based educational program** that requires component integration and software development to enable J3016 (level 4) automated operation.
3. **Provide the latest resources, equipment and training needed to accelerate development.**
4. Have some fun along the way.

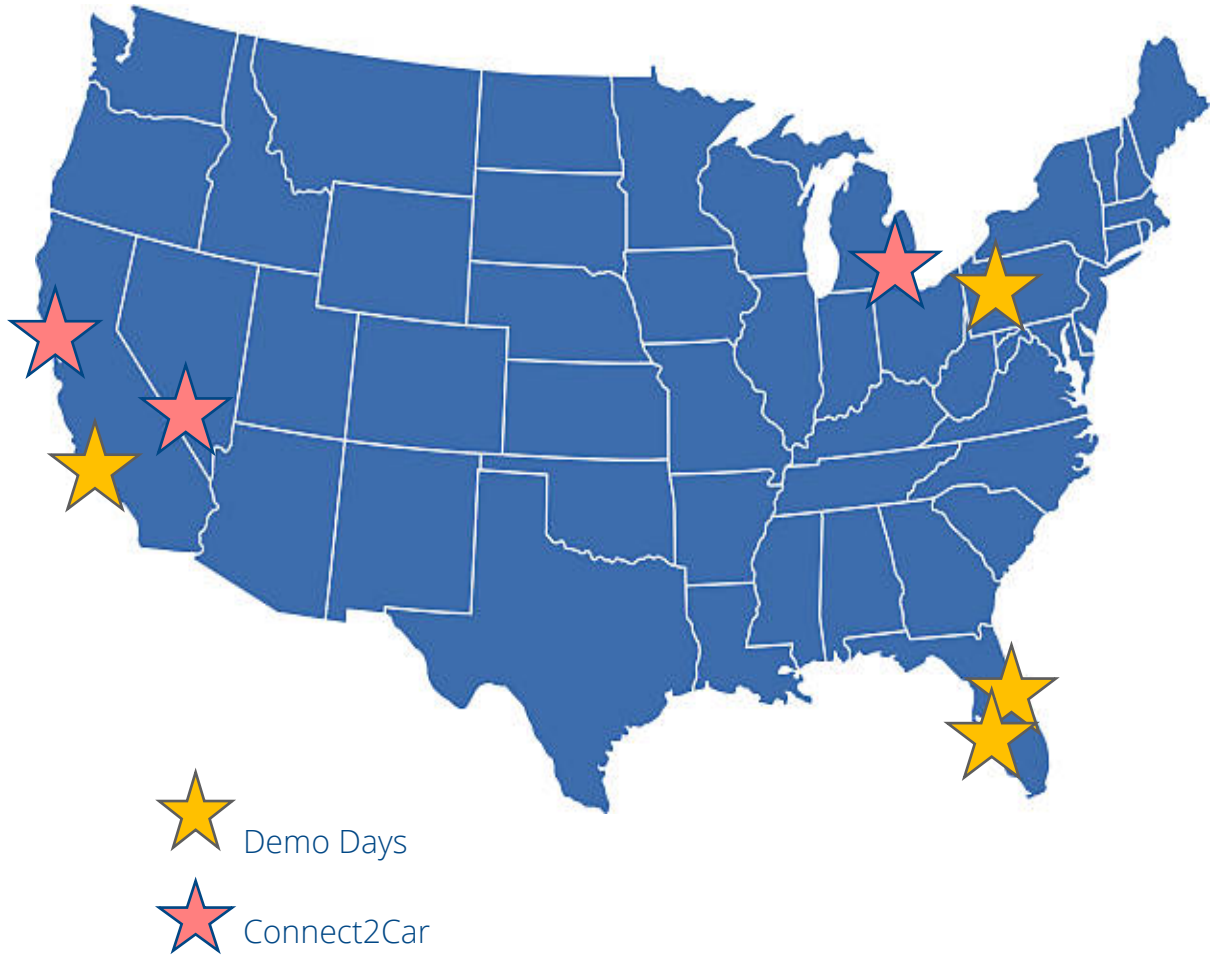
Texas A&M University · Kettering University · Michigan State University · North Carolina Agricultural and Technical State University · Michigan Tech · Virginia Tech · University of Toronto · University of Waterloo

SAE International

General Motors · Continental (Radar Supplier) · intel (Compute Platform Supplier) · MathWorks (Simulation Software Supplier) · Velodyne LiDAR (LiDar Supplier) · Altair · Bosch (Invented for life) · SOLIDWORKS · here · Kistler · MSC Software · NovAtel · ON Semiconductor · OXTS · ZF

Public Awareness - SAE Demo Days and Connect2Car

- Educates the public through direct interaction and participation with automated vehicle demonstrations around the United States.
- For the inaugural SAE Demo Day in Tampa, FL, participants traveled on a public freeway in a fully-autonomous (SAE Level 4) vehicle developed by Perrone Robotics. (SAE)



SAE MOBILUS

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SAE Standards

SAE Ground Vehicle Standards (J Reports).....2,100+
SAE Aerospace Material Specifications (AMS)..... 2,700+
SAE Aerospace Standards (AS).....4,900+
SAE Historical Standards .....35,000+

SAE eBooks.....400+
SAE Technical Papers ..... 100,000+
SAE eMagazines .....9,000+

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SAE MOBILUS Knowledge Hubs

https://saemobilus.sae.org/

The SAE MOBILUS Knowledge Hubs are gateways to curated, informative and trusted mobility engineering resources.

SAE Journals

Aerospace, Alternative Powertrains; Commercial Vehicles; Connected and Automated Vehicles, Engines; Fuels and Lubricants, Materials and Manufacturing; Passenger Cars – Electronic and Electrical Systems, Passenger Cars – Mechanical Systems; Transportation Safety; Transportation Cybersecurity and Privacy; Vehicle Dynamics, Stability, and NVH

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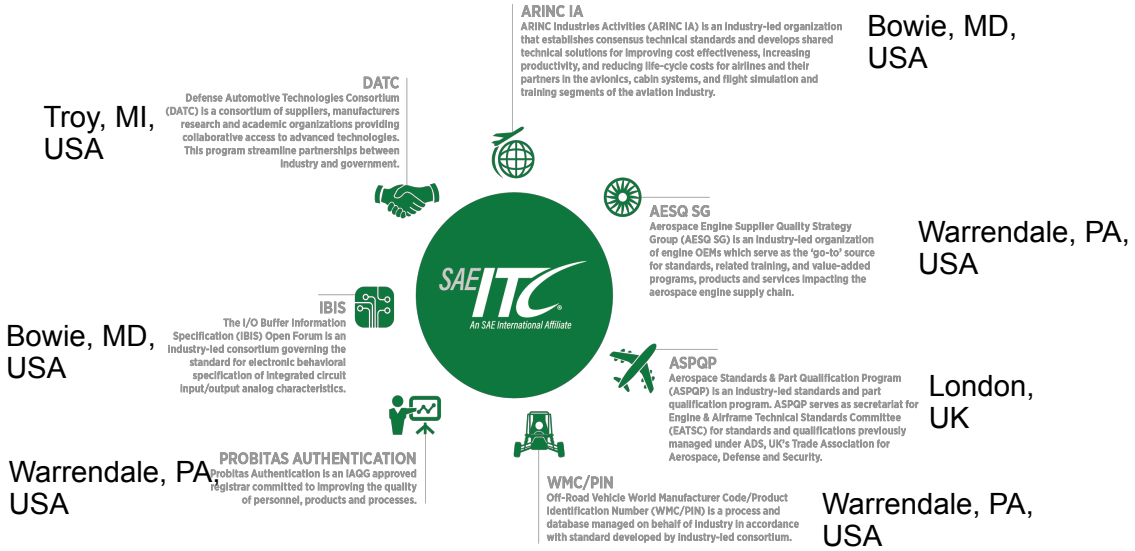
SAE Office of Automation

Coordinate development and dissemination of technical information, workforce development and public awareness initiatives across industry and SAE

Developing a pre-competitive, industry-wide approach to variable performance testing (VPT) for ADS safety assurance that ensures public confidence.



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