

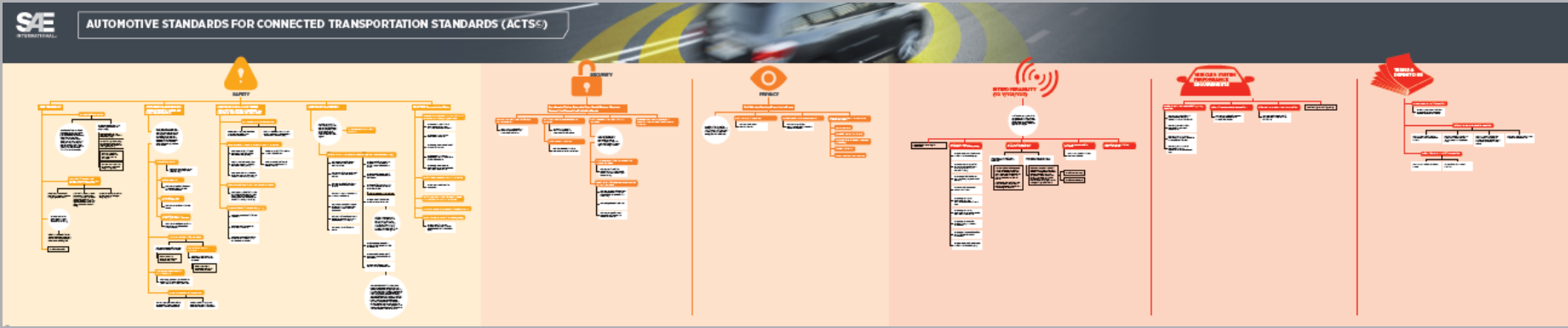
A blurred black car is driving on a road, moving from left to right. The car is surrounded by a large, stylized yellow circular graphic that resembles a ripple or a signal. The background is a blurred road with white lane markings. The overall image conveys a sense of motion and technology.

AUTOMATED & CONNECTED TRANSPORTATION STANDARDS

KEY TO NEW VEHICLE TECHNOLOGIES

Automated Vehicle Symposium

SAE Automated & Connected Transportation Standards



<http://alwaysinmotion.sae.org/>

SAE Automated & Connected Transportation Standards



SAE Automated & Connected Transportation Standards

PART 1:

- **TERMS & DEFINITIONS**
- **INTEROPERABILITY**
- **VEHICLE & SYSTEM PERFORMANCE REQUIREMENTS**

- Taxonomy & Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems (SAE J3016 — an Industry first™)
- Operational Definitions of Driving Performance Measures & Statistics (SAE J2944™)
- Definition of Hands-Free Operation of a Person to Person Wireless Communication System or Device (SAE J2972)
- Automated Vehicles Definitions: Key Terms Related to Human Interaction with Automated Driving Systems (Standard in progress, SAE J3114)
- Active Safety Systems Sensors (Standard in progress, SAE J3088)





TERMS & DEFINITIONS

SAE Automated & Connected Transportation Standards

PART 1:

- **TERMS & DEFINITIONS**
- **INTEROPERABILITY**
- **VEHICLE & SYSTEM PERFORMANCE REQUIREMENTS**



INTEROPERABILITY (V2V, V2I, V2X)

- Dedicated Short Range Communication (DSRC) Message Set Dictionary (SAE J2735™ – expected to be cited in NHTSA FMVSS rulemaking)
- On-Board System Requirements for V2V Safety Communications (SAE J2945/1™ – expected to be cited in NHTSA FMVSS rulemaking)
- DSRC Requirements for V2V Safety Awareness (Standard in progress, SAE J2945/2)
- Candidate Improvements to DSRC (SAE J2735™) Using Systems Engineering Methods (SAE J3067)
- Mobile Device Applications (Standards needed)
- Road Side Equipment for I2V and V2I (Standards needed)
- Performance Requirements for Safety Communications to Vulnerable Road Users (Standard in progress, SAE J2945/9)
- Recommended Practices for MAP/SPaT Message Development (Standard in Progress, SAE J2945/10)
- Recommended Practices for Signal Preemption Message Development (Standard in progress, SAE J2945/11)
- Recommended Practice for Pass-Thru Vehicle Programming (SAE J2534™)
- Automated Driving Reference Architecture (Standard in progress, SAE J3131)

SAE Automated & Connected Transportation Standards

PART 1:

- **TERMS & DEFINITIONS**
- **INTEROPERABILITY**
- **VEHICLE & SYSTEM PERFORMANCE REQUIREMENTS**



- **DSRC Common Performance Requirements**
(Standard in progress, SAE J2945™)
- **On-Board System Requirements for V2V Safety Communications**
(SAE J2945/1™ – expected to be cited in NHTSA FMVSS rulemaking)
- **Performance Requirements for Cooperative Adaptive Cruise Control and Platooning** (SAE J2945/6™)
- **Performance Requirements for Safety Communications to Vulnerable Road Users** (Standard in progress, SAE J2945/9™)
- **Automatic Emergency Braking Test Methods and Performance Assessment** (Standard in progress, SAE J3087™)
- **Adaptive Cruise Control Operating Characteristics and User Interface** (SAE J2399™)
 - **Recommended Practice for Pass-Thru Vehicle Programming** (SAE J2534™)
 - **Automated Driving Reference Architecture**
(Standard in progress, SAE J3131)



SAE Automated & Connected Transportation Standards

PART 2: SAFETY

* Functional Safety standards are intricately tied to the following standards:

- Security
- Vehicle Systems & Requirements
- Active Safety/Advanced Driver Assistances Systems & Levels of Automation
- Safety & Reliability: Electronics & Electrical Systems, Hardware/Software Verification & Validation

FUNCTIONAL SAFETY*



- Considerations for ISO 26262 Automotive Safety Integrity Levels (ASIL)
(SAE J2980; provides additional guidance for motion control & collision related hazards)
- Considerations for Non-Motion Hazards & Developer Interface Agreements
(Phase 2, SAE and ISO)
- Truck & Bus Brake and Stability Controls Functional Safety
 - Serial Control & Communications Heavy Duty Vehicle Network
(Recommended Practice in progress, part of SAE J1939™ series)
 - Heavy Duty Trucks Functional Safety
(SAE and ISO 26262)
- SAE J1939™ Communication Network Guidelines for Achieving Specific Safety Levels
(In progress, SAE Cooperative Research Program)
- Cybersecurity Recommended Practice for Cyber-Physical Vehicle Systems
(SAE J3061™ — an industry first)

SAFETY & RELIABILITY



Electronics & Electrical Systems, Hardware/Software Verification & Validation

- Dynamic Test Procedures for Verification & Validation of Automated Driving Systems
(Standard in progress, SAE J3092)
- Guidelines for Safe On-Road Testing of SAE Levels 3, 4, & 5 Prototype Automated Driving Systems
(SAE J3018™ — a much requested guide)
- Product Development Process & Checklist for Vehicle Electronic Systems
(SAE J1938)
- Handbook for Robustness Validation of Automotive Electrical/Electronic Modules (SAE J211)
- Handbook for Robustness Validation of Semiconductor Devices in Automotive Applications (SAE J1879)
- Reliability Prediction for Automotive ELECTRONICS (Standard in progress, SAE J3083)
- Design FMEA (Potential Failure Mode & Effects Analysis) and Process FMEA
(Standard in progress, SAE J1739)
- System Reliability & Integration
(Standard revision in progress, SAE J2925)
- Report on Unmanned Ground Vehicle Reliability (SAE J2958)
- Use of Model Verification & Validation in Product Reliability & Confidence Assessments (SAE J2940)

SAE Automated & Connected Transportation Standards

PART 2: SAFETY

ACTIVE SAFETY



Advanced Driver Assistance Systems & Levels of Automation

- Active Safety Systems Sensors (Standard in progress, SAE J3088)
- Automatic Emergency Braking Test Methods & Performance Assessment (Standard in progress, SAE J3087™)
- Specifications of Pedestrian Mannequins for Vehicle Pedestrian Detection Systems (Standard in progress, SAE J3116)
- Truck & Bus Lane Departure Warning Systems Test Procedure (SAE J3045)
- Truck & Bus Forward Collision Warning & Mitigation Vehicle Test Procedure (SAE J3029)
- Recommended Practice for Braking, Stability, & Control Performance Test Procedure of Air-Brake-Equipped Trucks (Standard in progress, SAE J1626/2)
- Taxonomy & Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems (SAE J3016™ — an industry first)
- Test Target Correlation (Standard in progress, SAE J3122)

SAFETY & HUMAN FACTORS



- Driver-Vehicle Interface Considerations for Lane Keeping Assistance Systems (SAE J3048)
- Guidelines for Speech Input & Audible Output in Driver Vehicle Interface (SAE J2988)
- Operational Definitions of Driving Performance Measures & Statistics (SAE J2944™)
- Process for Comprehension Testing of In-Vehicle Icons (SAE 2030)
- Human Factors in Forward Collision Warning Systems Operating Characteristics & User Interface Requirements (SAE J2400)
- Development of Design & Engineering Recommendations for In-Vehicle Alphanumeric Messages (SAE J2831)
- ITS In-Vehicle Message Priority (Standard revision in progress, SAE J2395)
- Definition of Hands-Free Operation of a Person to Person Wireless Communication System or Device (SAE J2972)
- Adaptive Cruise Control Operating Characteristics & User Interface (SAE J2999™)
- Calculation of Time to Complete In-Vehicle Navigation & Route Guidance Tasks (Standard in progress, SAE J2365)
- Automated Vehicles Definitions: Key Terms Related to Human Interaction with Automated Driving Systems (Standard in progress, SAE J3114)
- Road/Lane Departure Warning Systems: Information for the Human Interface (Standard revision in progress, SAE J2808)
- Truck & Bus Drive Distraction (Standards needed)

OTHER SAFETY



- On-Board System Requirements for V2V Safety Communications (SAE J2945/1™ — expected to be cited in NHTSA FMVSS rulemaking)
- DSRC Requirements for V2V Safety Awareness (Standard in progress, SAE J2945/2)
- Performance Requirements for Safety Communications to Vulnerable Road Users (Standard in progress, SAE J2945/9)
- Adaptive Driving Beam System (Standard in progress, SAE J3069)
- Uniform Pavement Markings for Machine Vision Systems (Standard in progress, SAE J4ASHT0)
- Truck & Bus Automated Commercial Vehicle (Standards needed)
- Recommended Practices for MAP/SPaT Message Development (Standard in Progress, SAE J2945/10)
- Recommended Practices for Signal Preemption Message Development (Standard in progress, SAE J2945/11)

SAE Automated & Connected Transportation Standards

PART 3:

- **PRIVACY**
- **SECURITY**

SECURITY*



- Cybersecurity Recommended Practice for Cyber-Physical Vehicle Systems (SAE J3061™ – an industry first)
- Requirements for Hardware Protected Security for Ground Vehicle Applications (Standard in progress, SAE J3101™)
- OBD II for Telematics, Vehicle Health Management, Data Access; Vulnerabilities & Cyber Threat Analysis; OTA Updates (SAE J1939™, J1979, J3005™, and J2534™)
- Automotive Networks of Connected Systems, Sensors & Physical Objects (SAE Standards Internet of Things–IoT–Steering Committee formed)

PRIVACY



- Data Collection, Retention, Ownership & Access (SAE J1939™, SAE J1979 [E/E Diagnostics/OBD II], and SAE J2534 Document Series); additional standards needed
- Pedestrian Protection EDR Parameters (SAE J1698-1A; SAE J1698 - standard revision in progress)
- Permanently or Semi-Permanently Installed Diagnostic Communication Devices (SAE J3005™)



Jack Pokrzywa
SAE Global Ground Vehicle Standards

- o +1.248.273.2460**
- m +1.248.219.2412**
- e jack.pokrzywa@sae.org**
- www.sae.org**