ADVANCED DRIVER ASSISTANCE SYSTEMS, CONNECTED VEHICLE AND DRIVING AUTOMATION STANDARDS, CYBER SECURITY, SHARED MOBILITY

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December 6, 2017
ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS)
ADAS Standards

**J3063™**
Active Safety System Terms & Definitions

**J2399™**
Adaptive Cruise Control (ACC) Operating Characteristics and User Interface

**J2802™**
Blind Spot Monitoring System Operating Characteristics & User Interface

**J3116™**
Active Safety Pedestrian Test Mannequin Recommendation

**J3029™**
Forward Collision Warning & Mitigation Vehicle Test Procedure – T&B
ADAS Standards

ADAS Related Documents – Work In-Process & Published

- **J3087 WIP**: Automatic Emergency Braking Performance Assessment Test Methods
- **J3122 WIP**: Active Safety Test Target Correlation
- **J3157 WIP**: Active Safety Bicyclist Test Targets Task Force – New
- **J3088™**: Active Safety Systems Sensors

Safety and Human Factors Standards Related to ADAS

- **J3045™**: Truck & Bus Lane Departure Warning Systems Test Procedure
- **J3048™**: Driver-Vehicle Interface Considerations for Lane Keeping Assistance Systems
- **J2988™**: Guidelines for Speech Input & Audible Output in Driver Vehicle Interface
- **J2400™**: Human Factors in Forward Collision Warning Systems Operating Characteristics & User Interface
- **J2831™**: Development of Design & Engineering Recommendations for In-Vehicle Alphanumeric Messages
- **J2972™**: Definition of Hands-Free Operation of a Person to Person Wireless Communication System or Device
- **J2399™**: Adaptive Cruise Control Operating Characteristics & User Interface
- **J2808™**: Road/Lane Departure Warning Systems: Information for the Human Interface
- **J3077™**: Definitions and Data Sources for the Driver Vehicle Interface (DVI)
SAE DSRC TC Documents

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

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

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

J2945/1 On-Board System Requirements for V2V Safety Communications
J2945/2 Performance Requirements for V2V Safety Awareness
J2945/3 Requirements for V2I Weather Applications
J2945/4 V2I Road Safety (title TBD) Applications
J2945/6 CACC/Platooning Performance Requirements
J2945/9 VRU (V2P) Safety Message Minimum Performance Requirements
J2945/10 Map/SPaT Related
J2945/11 Signal Preemption Related
J2945/12 Traffic Probe Use and Operation

Slide courtesy of Sue Bai, Chair SAE DSRC Committee
SAE DSRC TC Document: J2945/1

• 1st edition of on-board system requirements standard for V2V safety communications
• Support interoperability and data integrity
• Largely referenced by USDOT’s V2V safety system NPRM

Slide courtesy of Sue Bai, Chair SAE DSRC Committee
• Defines the safety message minimum performance requirements from pedestrian device (e.g. smartphone) to vehicles
• Protect pedestrians (including people with disabilities/special needs), cyclists, public safety workers
• Personal Safety message is defined in J2735
• Defines the performance requirements for V2V Safety Awareness Performance Requirements
  • Covers four applications: Emergency Vehicle Alert, Roadside Alert, Safety Awareness Alerts for Objects, Adverse Road Conditions
  • Includes needs and requirements, design, message and data (the message(s) defined in this document will be moved to J2735 at the next revision)
• Status: in final balloting
• Mostly V2I focus

• Support day-one benefit while V2V environment takes time to grow

**J2945/3**

**Requirements for V2I Weather Applications**
- Collect weather-related data from vehicles
- Distribute weather-sensitive information for safety and mobility. For example:
  - Enhanced maintenance decision support system
  - Weather advisory and warnings
  - Routing support for emergency responders
  - Weather-sensitive variable speed sign, ramp metering

**J2945/4**

**V2I Road Safety (title TBD) Applications**
- Infrastructure → Vehicle safety and mobility-related information
- Some of the candidate applications:
  - Curve speed warning
  - Reduced speed zone warning
  - More to add
  - Flexible message structure with application-specific container

Slide courtesy of Sue Bai, Chair SAE DSRC Committee
J2945/6 Cooperative ACC Performance Requirements

- Enhance ACC with V22 V2I communication
- Include platooning as Phase 2

J2945/10 Map/SPaT Message Recommended Practice

- Explain and demonstrate how to use these messages
- Intended for developers/users

J2945/11 Signal Preemption Recommended Practice

- Explain and demonstrate how to use signal request and preemption messages

J2945/12 Traffic Probe Use and Operation Recommended Practice

- Provide guidance on automated vehicle probe data collection and distribution

Slide courtesy of Sue Bai, Chair SAE DSRC Committee
Safety and Human Factors Standards Related to Connected Vehicles

- J2395™: ITS In-Vehicle Message Priority
- J2831™: Development of Design & Engineering Recommendations for In-Vehicle Alphanumeric Messages
- J2988™: Guidelines for Speech Input & Audible Output in Driver Vehicle Interface
- J2944™: Operational Definitions of Driving Performance Measures & Statistics
SAE Driving Automation Standards

J3016™
Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems

J3114™
Human Factors Definitions for Automated Driving and Related Research Topics

J3018™
Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)
<table>
<thead>
<tr>
<th>SAE Level</th>
<th>SAE Name</th>
<th>SAE Narrative Definition</th>
<th>Execution of Steering/ Acceleration/ Deceleration</th>
<th>Monitoring of Driving Environment</th>
<th>Fallback Performance of Dynamic Driving Task</th>
<th>System capability (driving modes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Automation</td>
<td>Hands, feet, brain, eyes ON</td>
<td>Human Driver</td>
<td>Human Driver</td>
<td>Human Driver</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>Hands or feet OFF brain &amp; eyes ON</td>
<td>Human Driver and Systems</td>
<td>Human Driver</td>
<td>Human Driver</td>
<td>Some Driving Modes</td>
</tr>
<tr>
<td>2</td>
<td>Partial Automation</td>
<td>Hands &amp; feet OFF brain &amp; eyes ON</td>
<td>System</td>
<td>Human Driver</td>
<td>Human Driver</td>
<td>Some Driving Modes</td>
</tr>
</tbody>
</table>

Automated driving system ("system") monitors the driving environment

| 3         | Conditional Automation    | Hands, feet, eyes OFF Brain ON            | System                                          | System                            | Human Driver                               | Some Driving Modes                |
| 4         | High Automation           | Hands, feet, eyes, brain OFF – Constrained environments;| System                                          | System                            | System                                    | Some Driving Modes                |
| 5         | Full Automation           | Hands, feet, eyes, brain OFF Unconstrained | System                                          | System                            | System                                    | All Driving Modes                 |
J3018™: Safe On-Road Testing Guidelines

SAE J3018™ Safe On Road Testing Guidelines, Levels 3-5

Document provides guidelines for the safe conduct of on-road tests of vehicles equipped with prototype conditional, high, and full (levels 3-5) automated driving systems (ADS), as defined by J3016™.

- Test driver training
- Test driver workload
- Test program management
- Functional safety
- Operating conditions
- Graduated road testing
- Test data capture
- Safety override
- Software development and release requirements
SAE J3131 defines an automated driving reference architecture that contains functional modules supporting future application interfaces for Levels 3 through 5 (J3016™).
CYBER SECURITY
SAE Cyber Security Standards

- Vehicle Cyber Security Systems Engineering Committee
  - J3061™: Cybersecurity Recommended Practice for Cyber-Physical Vehicle Systems
- Truck and Bus Controls and Communications Network Committee
  - J1139™: Serial Control and Communications – Heavy Duty Vehicle Network
- Vehicle Electrical Systems Security
  - J2101 WIP: Requirements for Hardware Protected Security for Ground Vehicle Applications
J3061™: Cybersecurity Recommended Practice for Cyber-Physical Vehicle Systems

- J3061™ published in January 2016
- Helps drive a process to address cyber security threats to the automotive environment
- Provides the guidance and information to help organizations develop and integrate cybersecurity into their product development life-cycle, not add cybersecurity post-production
- Provides a foundation for further security standards development and is the “go-to” resource throughout industry
- ISO joint work activity
SHARED
Goals of Shared and Digital Mobility

- To leverage technology and excess supply to provide traveler-centric, quality, flexible mobility options for all*
- Shared mobility is fueled by:
  - Increasing cost & Idle Assets (95%+)
  - Rapidly advancing technologies increase viability for sharing
  - Increasing traveler expectations & options
  - Demographic changes (Millennials and aging population)
  - Reduced interest in vehicle ownership
- Environmental concerns:
  - Congestion and travel time
  - Limited resources
- SAE established the Shared and Digital Mobility Committee:
  - Common terms and definitions
  - AV sharing – data specification, etc.

*https://www.its.dot.gov/factsheets/pdf/MobilityonDemand.pdf
Thank you

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