FIRST REVISION OF J3016 – UPDATE ON TASK FORCE ACTIVITIES

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Background

Revision history of original version of J3016

- Full ORAV review August 2012
- Survey ballot DEC2012 (closed 04JAN2013) – passed
- 1st formal ballot FEB2013 – passed unanimously with comments
- 2nd formal ballot NOV2013 – passed unanimously with minor comments
- Published 11JAN2014

Primary source/reference documents for J3016:JAN2014

- BASt (Tom Gasser, et al.)
- NHTSA draft definitions (presented at January, 2013, SAE G-I Meeting)

Motivation for revisions to J3016

- BASt/VDA/OICA harmonization with J3016 taxonomy and supporting definitions for WP29 discussions
- Application and adaptation of J3016 levels and definitions in AdaptIVe and CAMP AVR projects
- Information and ideas gleaned from other sources (conferences, meetings, academic exchanges, etc.)

Summary table describing levels (SAE J3016:JAN2014)

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	**No Automation**	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	**Driver Assistance**	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	**Partial Automation**	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ("system") monitors the driving environment**						
3	**Conditional Automation**	the *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	**High Automation**	the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	**Full Automation**	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Characteristics of the DDT, fallback operation, and operational design domain determine the level of each driving automation system application.

Does the driving automation feature:

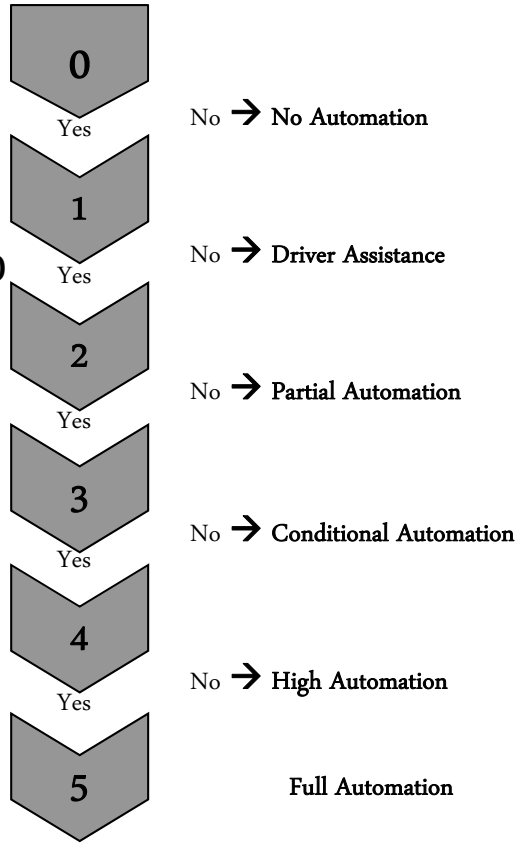
Perform sustained control of lateral **or** longitudinal vehicle motion, but rely on the driver to perform the remainder of DDT?

Perform **both** sustained longitudinal **and** sustained lateral vehicle motion control, but rely on the driver to complete OEDR?

Perform complete DDT during normal operation, but rely on the human user to perform DDT fallback?

Perform complete DDT and DDT fallback within a limited operational design domain, without need for intervention by a human user?

Perform complete DDT and DDT fallback in all on-road conditions, without need for intervention by a human user?



Blue text indicates new terms to be defined in revised J3016

1st revision of J3016 – ground rules

Maintain

- The 6 levels, including names and numbers
- The functional differentiators for the levels (clarification and/or augmentation, only)
- Table 1 framework and step-wise logic (wording changes, only)

Revisions include

- Clarify and rationalize taxonomical differentiator(s) for lower levels
- Clarify scope of taxonomy (to what it does and does not apply)
- Modify existing, and add new, supporting terms and definitions
- Add more rationale, examples, and explanatory text throughout

Clarify and rationalize taxonomical differentiator(s) for lower levels and Clarify scope of taxonomy (to what it does and does not apply)

The SAE J3016 taxonomy classifies those driving automation features that serve to automate part or all of the DDT on a sustained basis, and thus fundamentally alter the driver's role.

- DRAFT definition of sustained (operation): "*Performance of part or all of the DDT between and across external events, including responding to external events and continuing performance of the DDT in the absence of external events.*"
- External events are defined as situations in the driving environment that necessitate a response
- Driving automation that is not sustained does not qualify as driving automation and is not classifiable (other than at level 0) under the J3016 taxonomy.
    - Systems that provide momentary intervention (e.g., ABS, ESC, AEB, etc.) do not perform any part of the DDT on a sustained basis.
    - Conventional cruise control does not provide sustained operation because it does not respond to external events.

Modify existing, and add new, supporting terms and definitions

New supporting terms and definitions:

- driving automation system (vs. ADS)
- (driving automation system) feature or application
- DDT fallback
- (human) user
  a. driver/operator
     - (conventional) driver
     - remote driver/operator (teleoperator)
  b. passenger
  c. DDT fallback-ready user
  d. dispatcher
- monitor
  a. monitor the driver
  b. monitor the driving environment
  c. monitor vehicle performance
  d. monitor driving automation system performance
- object and event detection and response (OEDR)
- operational design domain (ODD)
- supervise
- sustained
- usage specification
- (user) receptivity

Add more rationale, examples, and explanatory text throughout

Example: DRAFT definition of “monitor driving automation system performance”

The driver activities, performed while using a level 1 or 2 driving automation system, that accomplish evaluation of the driving automation system performance with respect to the driving environment, including response preparation, but excluding any actual response.

Example 1: A conventional driver verifies that an active ACC system is following a preceding vehicle correctly in a curve.

Example 2: A remote operator activating a level 2 automated parking feature monitors the pathway of the vehicle to ensure that it is free of pedestrians or other obstacles.

Note 1: The term “monitor the driving automation system performance” should not be used in lieu of “supervise,” which includes both monitoring and responding, and therefore is more comprehensive.

Note 2: Recognizing driving automation system-issued alerts is not a form of monitoring driving automation system performance, but rather a form of receptivity.

Note 3: At higher levels of automation (levels 3-5), the ADS self-monitors its performance, but this is not considered “monitoring of driving automation system performance,” as the definition would otherwise be circular.

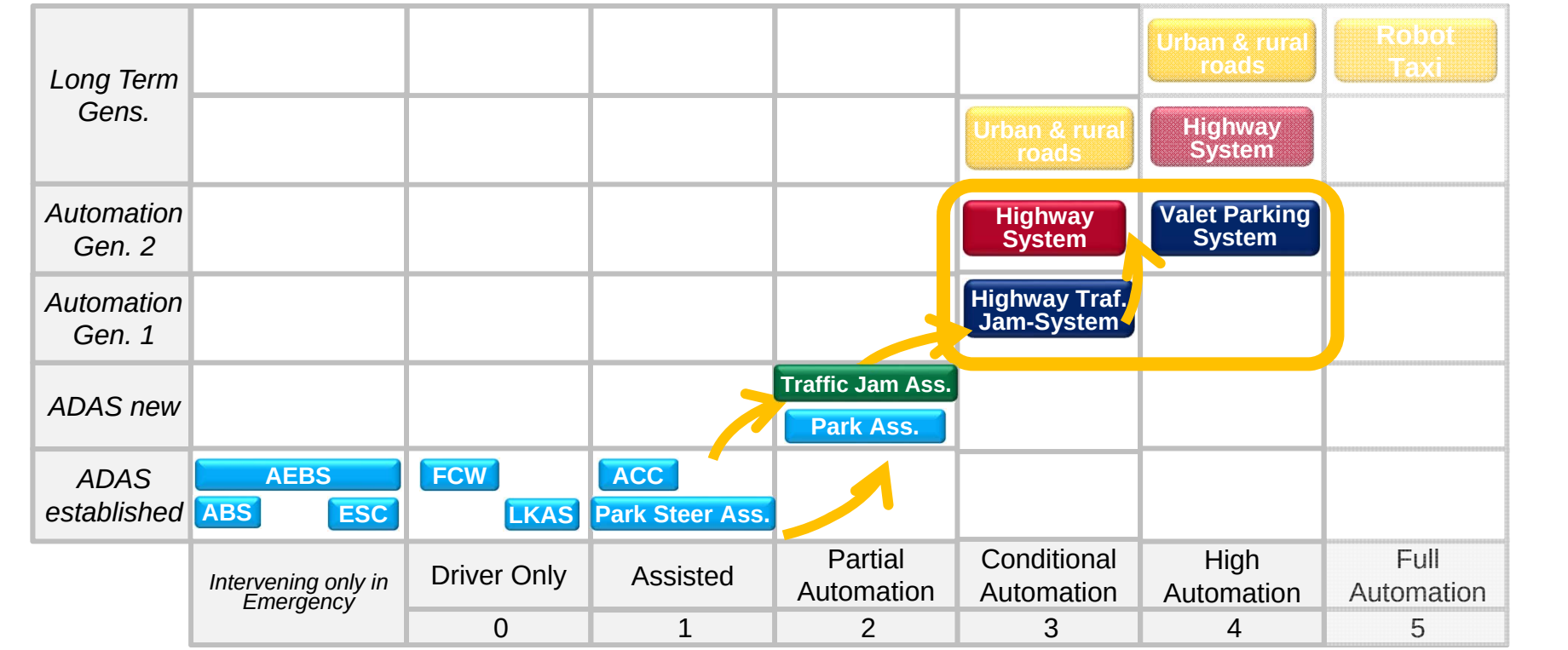
Practical use of SAE J3016 in Europe: AdaptIVe Project

AdaptIVe (Automated driving applications and technologies for Intelligent Vehicles)

- €25 million project running January 1, 2014 - June 30, 2017
- Co-funded by the European Commission as part of the Seventh Framework Programme with €14.3 million supported by the European Council for Automotive R&D, EUCAR
- 29 partners from 8 countries – France, Germany, Greece, Italy, Spain, Sweden, The Netherlands, United Kingdom; including 11 original equipment manufacturers, 4 suppliers, 11 research institutes and universities, and 3 small/medium enterprises
- Objectives include human factors issues, evaluation methods, and legal aspects
- Deliverable D2.1 - System Classification and Glossary
  - Describes harmonization of levels between BASt, VDA, and SAE
  - Applies these harmonized levels and SAE J3016 supporting terms
  - Provides further granularity via a systematic methodology for applying additional classification parameters
  - Document available for download:

    https://www.adaptive-ip.eu/index.php/deliverables_papers.html

Roadmap



ADAS Advanced Driver Assistance Systems
AEBS Advanced Emergency Braking
ESC: Electronic Stability Control
ABS: Antilock Braking System
LKAS: Lane Keeping Assistance
FCW: Forward Collision Warning
ACC: Adaptive Cruise Control

Practical use of SAE J3016 in US: CAMP AVR Project

CAMP AVR (Crash Avoidance Metrics Partnership Automated Vehicle Research)

- Cooperative Research Agreement with NHTSA running from November, 2013 through July, 2015
- Consortium members: Ford Motor Company, General Motors, Nissan, Mercedes-Benz, Toyota, and Volkswagen Group of America
- Objectives included: functional descriptions of automation levels, list of potential driving automation features, level-specific safety principles, potential objective test methods for evaluating driving automation systems
- CAMP AVR Consortium incorporated the SAE J3016 levels and supporting terms and embellished upon them
- Final report has been submitted to NHTSA