Next Generation Transport Session

International standardization of Low-Speed Automated Driving systems Current Status

ISO/TC204/WG14 Japanese mirror committee
Last-mile SWG, JSAE
Kazuki TAKAHASHI (Yamaha motor Co., Ltd.)

Last-mile transport system and LSAD system

Low-Speed Automated Driving system

- **"Last-mile" = "Last-one-mile"**
  - the last interval where the service reach a customer
  - short distance between a nearest transportation hub and the final destination

    railway stations , bus depots etc. *own home etc.*

- **"Last-mile" is not directly equal to "LSAD system"**

  however

- **"LSAD system" is expected to play a big role** as a Last-mile transportation system for its specific functions and tasks

Feature of the "Last-mile transport system"

As a Service;
- ✓ Need to operate in an area where conventional public transportations are generally not available (cf. Zone 30)
- ✓ Not a mass transportation
- ✓ Priority on flexibility for the users' (passengers') personal needs, rather than efficiency and speed
- ✓ On-demand style for small number of passengers

As a vehicle system;
- ✓ Finite operational routes, then limited amount of map information for automated driving
- ✓ No need to operate with high-speed
- ✓ Short duration for one trip riding time etc.

Let "Last-mile transport system" mean LSAD system hereafter

Summary of levels of driving automation (SAE-J3016 :SEP2016)

Level	Name	DDT		DDT fallback	ODD
		Sustained lateral and longitudinal vehicle motion control	OEDR		
Driver performs part or all of the DDT					
0	No Driving Automation	Driver	Driver	Driver	n/a
1	Driver Assistance	Driver and System	Driver	Driver	Limited
2	Partial Driving Automation	System	Driver	Driver	Limited
ADS ("System") performs the entire DDT (while engaged)					
3	Conditional Driving Automation	System	System	Fallback-ready user (becomes the driver during fallback)	Limited
4	High Driving Automation	System	System	System	Limited
5	Full Driving Automation	System	System	System	Unlimited

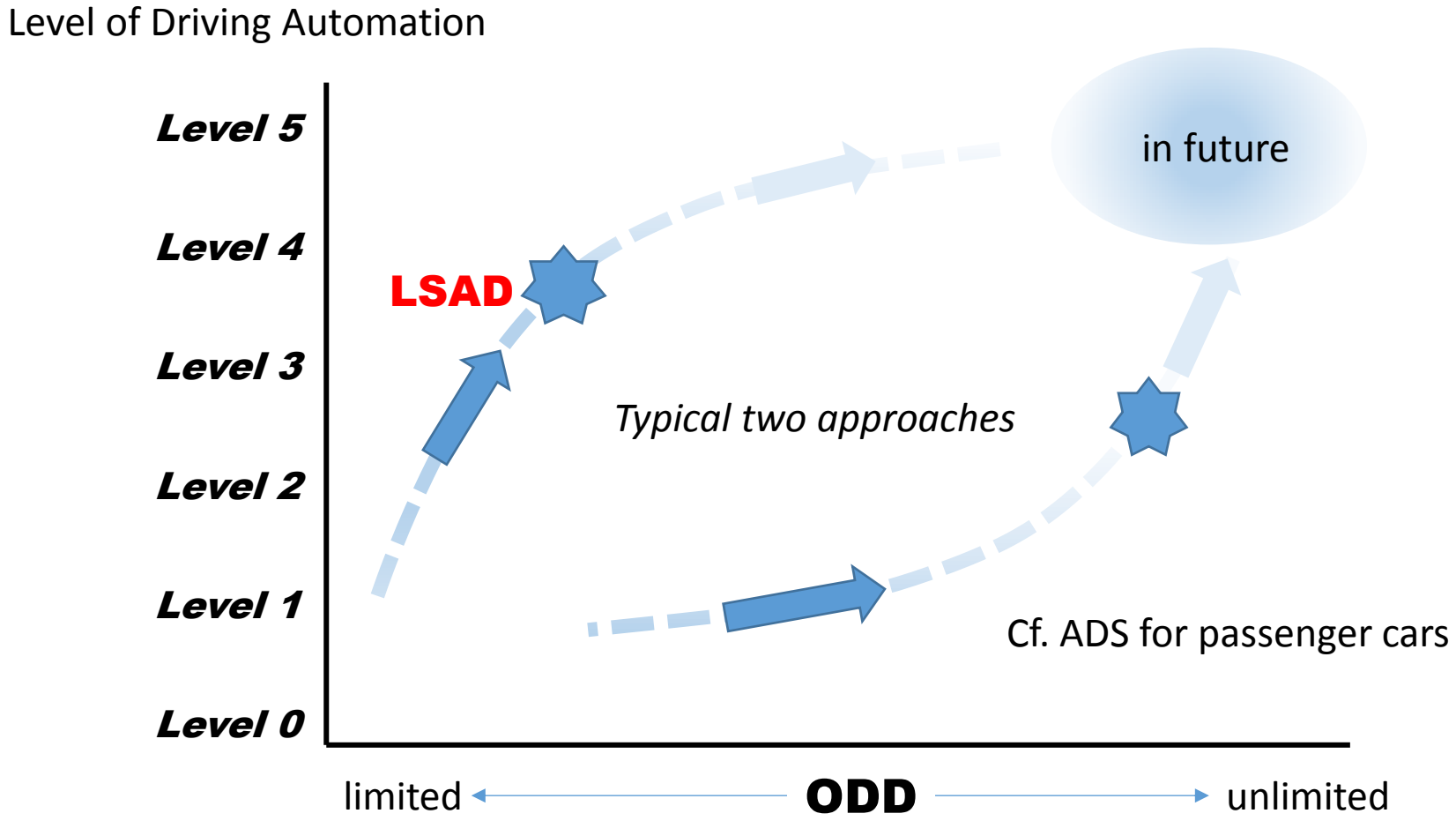
ADS: Automated Driving System *DDT: Dynamic Driving Task*
ODD: Operational Design Domain *OEDR: Object and Event Detection and Response*

ISO/SAE new joint project [ISO/SAE NP PAS 22736] has approved (Aug. 2017), and started (Oct.2017)

Intelligent transport systems -- Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles (revision of SAE-J3016)

LSAD systems

Aiming at earlier realization of highly automated driving system in limited ODD

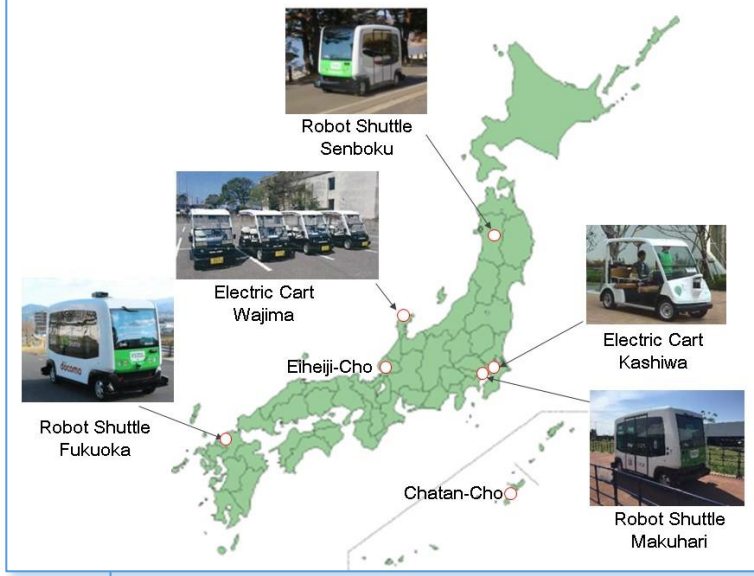


(ODD may include geographic, roadway, environmental, traffic, speed, and/or temporal limitations ; SAE J3016)

Last-mile transportation system, case examples in Japan

METI: Ministry of Economy, Trade and Industry
MLIT: Ministry of Land, Infrastructure Transport and Tourism
NILIM : National Institute for Land and Infrastructure Management

The field of tests or demonstrations carried out in Japan.



METI & MLIT Project - Last-mile
"R&D and demonstration project on smart mobility systems"

2016: Plan & Development
2017: Evaluation with relevant ministries and agencies.
2018: Demonstrations.

Demonstration for social implementation of the last-mile mobility system by automated and connected vehicles in dedicated zone.

Selected test place for LSAV
- Wajima-city, Ishikawa-Pref.
- Eiheiji-cho, Fukui-Pref.
- Chatan-cho, Okinawa-Pref.

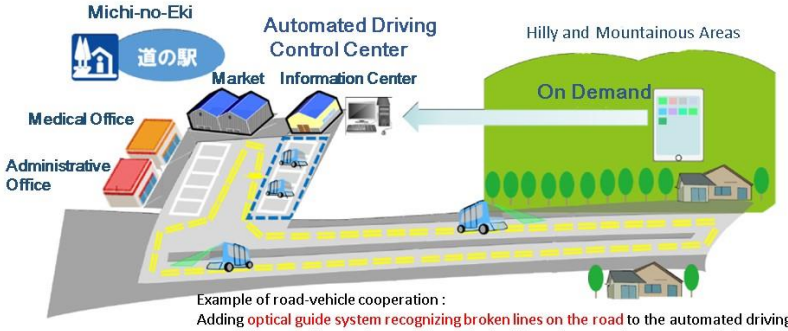

Control Center


Candidate Vehicles

Project description
- Examination of feasible business model of last-mile mobility system
- Demonstration and development of required technology for last-mile mobility system
- Discussion on institutional approach of technology and business aspects with relevant ministries

MLIT Project
Automated driving service based in the Michi-no-Eki (roadside station)

The field tests of automated driving services with cooperation between road and vehicle based in the roadside stations in order to ensure the commuting and logistic means in the Hilly and Mountainous Areas, where aging of the population is progressing.



Example of road-vehicle cooperation :
Adding optical guide system recognizing broken lines on the road to the automated driving system for example, to enhance safeness in the hilly and mountainous areas with low linearity

Since around 2013, many local trials have been executed for social implementation of last-mile transportation in Japan

a topic;
"Michi-no-Eki" by MLIT,NILIM
"Ashikita Dekopon" in Kumamoto Pref.
Oct.1st～Oct.7th, 2017.

Source: presentation slides by JP in ISO/TC204/WG14@Paris (Apr. 2017)

Last-mile transportation system, other examples

Shuttle and pod with LSAD system

DE InnoZ (source: https://www.innoz.de/en/innoz-living-lab-connected-mobility)

UK GATEway (source: https://gateway-project.org.uk/gallery/)

UK Autodrive (source: http://www.ukautodrive.com/downloads/)

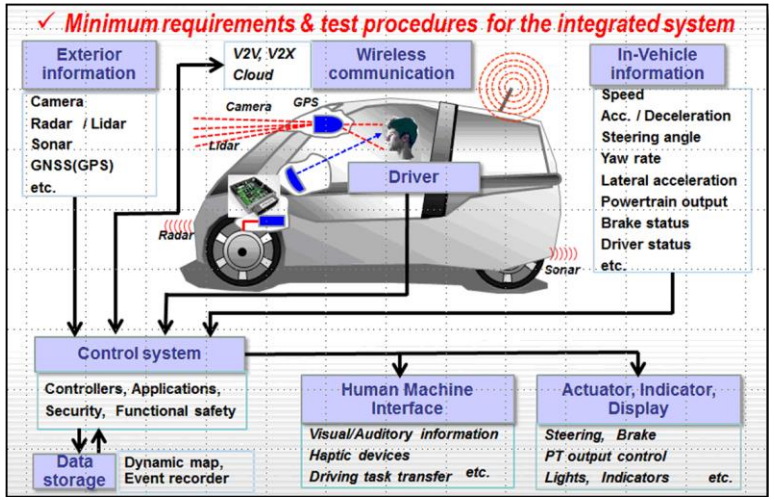
FR NAVYA (source: http://navya.tech/)

International standardization activity for Driving Automation systems

ISO
(International Organization for Standardization)

- TC22 Road Vehicles
- **TC204 Intelligent Transport Systems**
  - WG1 Architecture [US]
  - WG3 ITS database technology [JP]
  - WG4 Automatic vehicle and equipment identification [NO]
  - WG5 Fee and toll collection [SE]
  - WG7 General fleet management and commercial/freight [CA]
  - WG8 Public transport/emergency [US]
  - WG9 Integrated transport information. management and control [AU]
  - WG10 Traveler information systems[GB]
  - **WG14 Vehicle/roadway warning and control systems [JP]**
  - WG16 Communications [US]
  - WG17 Nomadic Devices in ITS systems [KR]
  - WG18 Cooperative systems [DE]

[*] Convener



Source: ISO/TC204/WG14

in Japan

JISC
(Japanese Industrial Standards Committee)

- **JSAE**
  WG14 mirror committee

JSAE : *Society of Automotive Engineers of Japan, Inc.*

ISO standardization project stages

Stage	Document name		Working track		
			Accelerated 2 years	Standard 3years	Extended 4years
00 preliminary	Preliminary work item	**PWI**			
10 proposal	New work item proposal	**NP**			
20 preparatory	Working draft	**WD**	--	12 months	12 months
30 committee	Committee draft	**CD**	+ 6 months	+6 months	+12 months
40 enquiry	Draft International Standard	**DIS**	+12 months	+12 months	+19 months
50 approval	Final draft International Standard	**FDIS**	+6 months	+6 months	+5 months
60 publication	International Standard	**IS**	Total 24 months	Total 36 months	Total 48 months

- Timer for IS working track starts when NP is approved.
- For NP approval, 2/3 in favor and 5 countries (4 countries, if P members ≦ 16) at least, are necessary from P members (TC204 has 28 P members).

Standards for ITS under ISO/TC204/WG14

Vehicle/roadway warning and control systems

Published

ISO/TS 15624:2001	TIWS	Traffic Impediment Warning Systems
ISO 17387:2008	LCDAS	Lane change decision aid systems
ISO 22178:2009	LSF	Low Speed Following systems
ISO 15622:2010	ACC	Adaptive Cruise Control systems
ISO 17386:2010	MALSO	Maneuvering Aids for Low Speed Operation
ISO 22840:2010	ERBA	Extended range backing aid systems
ISO 22839:2013	FVCMS	Forward vehicle collision mitigation systems
ISO 15623:2013	FVCWS	Forward vehicle collision warning systems
ISO 11270:2014	LKAS	Lane keeping assistance systems
ISO 26684:2015	CIWS	Cooperative intersection signal information and violation warning systems
ISO 11067:2015	CSWS	Curve speed warning systems
ISO 18682:2016	HNS	External hazard detection and notification systems
ISO 16787:2016	APS	Assisted Parking Systems
ISO 17361:2017	LDWS	Lane departure warning systems
ISO/TR 20545:2017	RoVAS	Report on standardization for vehicle automated driving systems

Standards for ITS under ISO/TC204/WG14

Vehicle/roadway warning and control systems

Current working items

ISO/FDIS 16787 Ed2	APS	Assisted parking system
ISO/FDIS 19237	PDCMS	Pedestrian detection and collision mitigation systems
ISO/DIS 20035	CACC	Cooperative adaptive cruise control systems
ISO/DIS 15622 Ed3	ACC	Adaptive cruise control systems
ISO/DIS 19638	RBDPS	Road Boundary Departure Prevention Systems
ISO/DIS 21717	PADS	Partially automated in-lane driving systems
ISO/CD 20900	PAPS	Partially automated parking systems
ISO/CD 20901	EEBL	Emergency electronic brake light systems
ISO/WD 22078	BDCMS	Bicyclist detection and collision mitigation systems
ISO/WD 21202	PALS	Partially Automated Lane Change Systems
ISO/SAE NP PAS 22736		Taxonomy and Definitions for Terms Related to Driving Automation Systems

Preliminary working items

ISO/PWI 22084	TINS	Traffic incident notification systems
ISO/PWI 22737	LSAD	Low-speed automated driving systems for limited operational design domain
ISO/PWI	AVPS	Automated Valet Parking systems
ISO/PWI	CALC	Collision avoidance in-lane lateral control systems
ISO/PWI	V2VICWS	Vehicle-to-vehicle intersection collision warning systems
ISO/PWI	FSV2V-1	Functional safety for vehicle-to-vehicle cooperative functions (FSV2V) – Part 1: Platooning

* additionally four more PWIs were registered after the 48th WG14 in San Antonio (Oct.,2017)

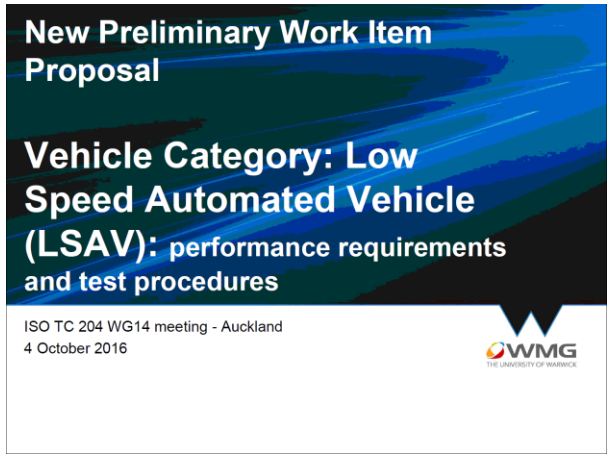
LSAD is started in WG14 as PWI

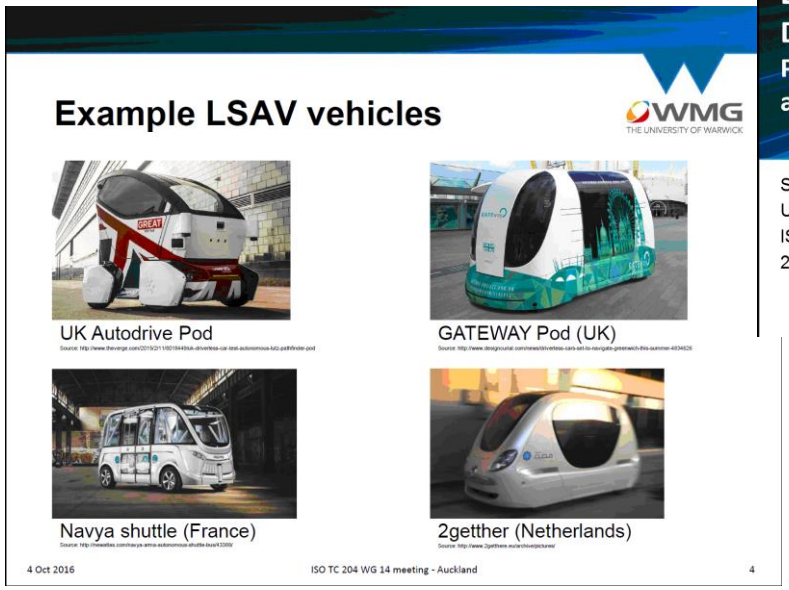
ISO/PWI 22737 (Current stage: 00.00)

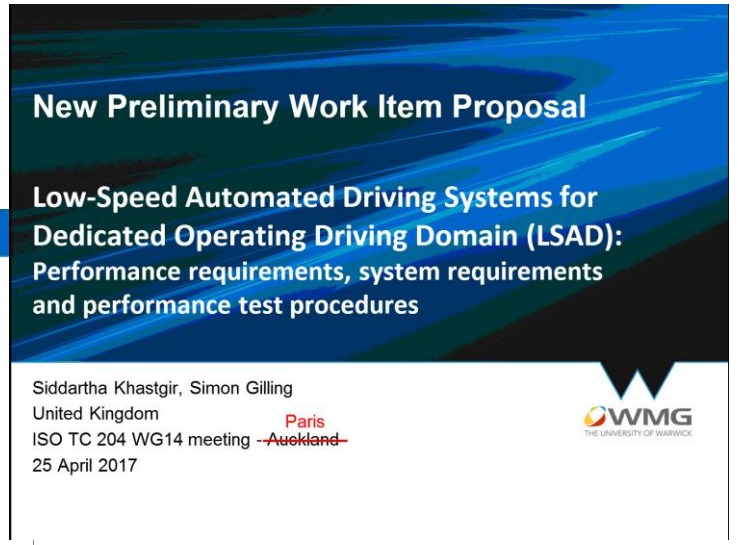
Intelligent transport systems -- Low-speed automated driving systems for limited operational design domain (LSAD) -- Performance requirements, system requirements and performance test procedures

Introduced in TC204/WG14, Oct. 2016@Auckland
Approved & registered as a PWI at TC204/WG14, Apr. 2017@Paris
Project leader : Khastgir, Siddartha Mr. (BSI Experts)

PWI supported by GBR, USA, KOR, HUN, CAN, JPN







Source: presentation slides by UK in ISO/TC204/WG14@Auckland (Oct. 2016), Paris (Apr. 2017)

The draft scope of proposed LSAD standard and its challenges

The draft scope (extraction) of the preliminary working item (ISO/PWI 22737)

Scope (*extraction*)
This international standard for Low-Speed Automated Driving (LSAD) systems addresses low speed road vehicles being operated in Limited Operational Design Domains. This standard contains the minimum performance requirements, system requirements and performance test procedures.

…

LSAD system are intended to be used on either restricted access roadways (public or private) or pedestrian / bicycle pathways. LSAD systems are not intended to be used on freeways or highways where non-motorized vehicles and pedestrians are prohibited. LSAD systems may be used on pre-determined routes.

…

Latest version after the WG14 meeting in Oct. 2017

Major points to be discussed;

- **Levels of driving automation of LSAD and its specific minimum risk maneuver**
- **Interpretation of "Low-speed", and its corresponding obstacle detection capability**
- **Limitation of ODD for acceptable LSAD operation, e.g. low-speed, restricted path, . . .**
- **Clear definition of "Supervisor" and "Dispatcher" and their role**
- **Minimum performance requirements and its test procedures**

etc.

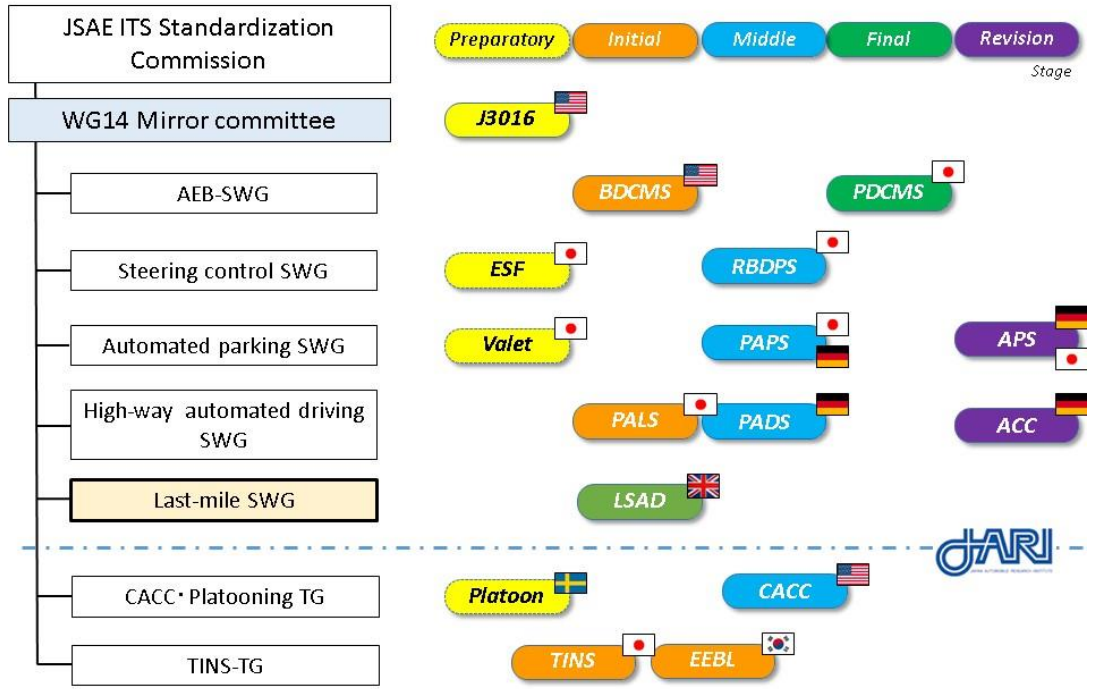
Japanese framework for the PWI, and basic policy for it

Japanese position for PWI 22737 (LSAD)

Actively contribute
toward useful standard

"Last-mile SWG" has been organized
under the WG14 mirror committee

SWG/TG Framework 2017 of WG14 Mirror Committee in JP

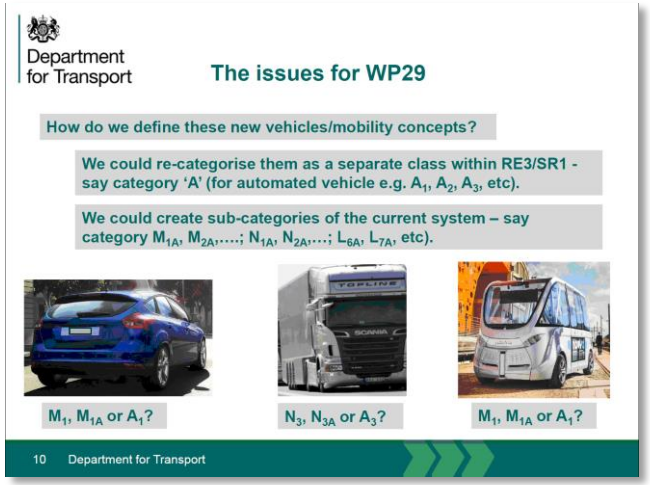


Issues to be clarified for LSAD to be socially implemented

- Low-speed operation
- Transportation service business, rather than owner's car
- "Limited" ODD for enabling higher ADS (SAE Lv.4)

Continuous monitoring WP29

Brain-storm discussion of vehicle category including Pod and Shuttle type Automated Vehicle has started

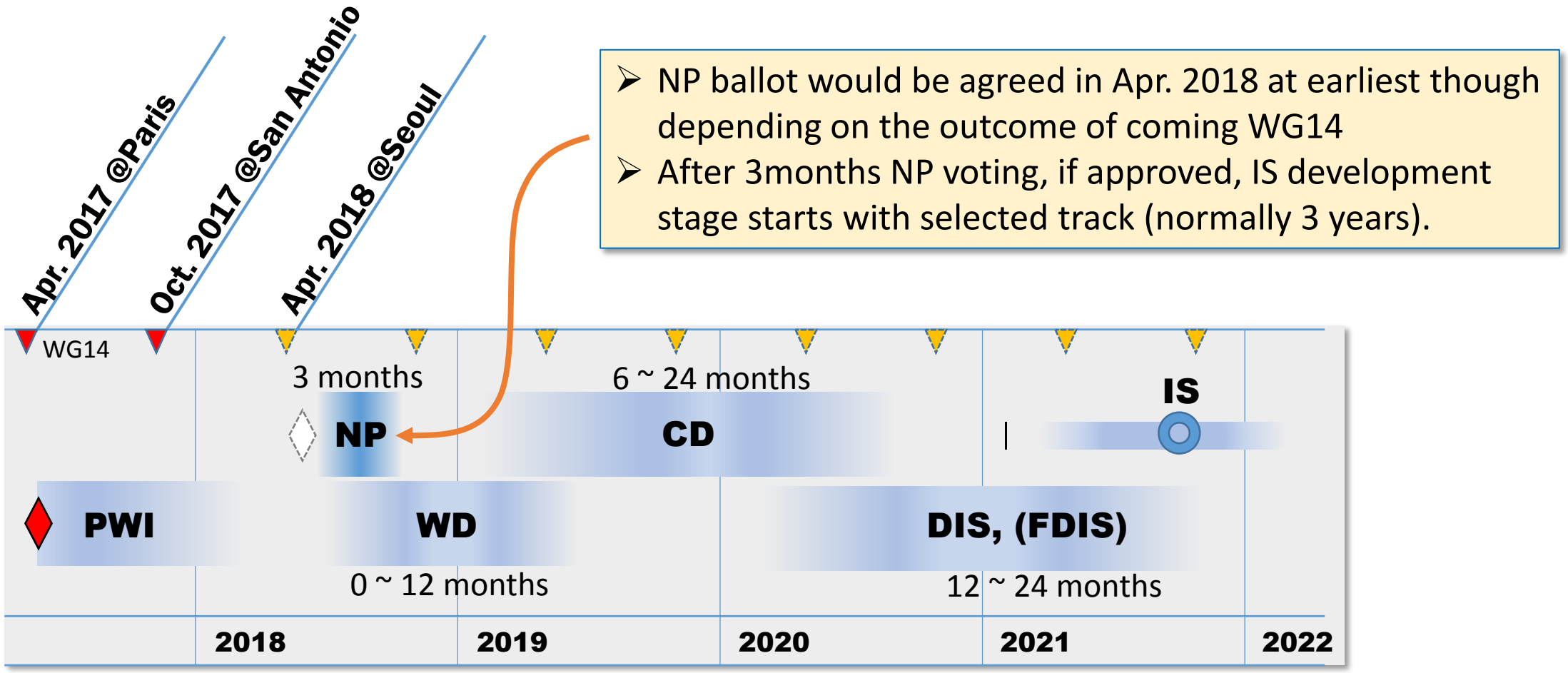


submitted by UK WP29/ITS/AD-12-12

Expected project schedule for the PWI

ISO/PWI 22737

Intelligent transport systems -- Low-speed automated driving systems for limited operational design domain (LSAD) -- Performance requirements, system requirements and performance test procedures



- NP ballot would be agreed in Apr. 2018 at earliest though depending on the outcome of coming WG14
- After 3months NP voting, if approved, IS development stage starts with selected track (normally 3 years).

Conclusion

- PWI stage of LSAD international standard has officially started in ISO/TC204/WG14.
- NP ballot would be opened soon (2018 ?) to get approval by TC204.
- At least 5 countries who send expert(s) are necessary to start the ISO project stage.
- Japan will actively contribute to the Work Item in order to make it a useful standard.
- Your attention to the progress of this item is kindly requested if you have interest on it.

Thank you