Panel on Business Strategies in Automated Driving
“Action Plan for Realizing Automated Driving”
Version2.0

March 30, 2018

Panel on Business Strategies in Automated Driving

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1. Introduction

With expanded use of vehicles expected amid an increase in the world's population especially in urban areas, it will be increasingly necessary to reduce traffic accidents, relax traffic congestion and reduce environmental loads. It is very unlikely that far-reaching solutions to such problems will be found with existing actions alone. Therefore, high expectations have been placed on the new endeavor of Automated Driving and the expansion of related markets is expected.

For Japan, Automated Driving is a field where growth is anticipated and it is, therefore, important to secure its competitiveness. However, while Japanese automobile manufacturers are leading the world alongside American and European manufacturers, the situation is not so optimistic for Japan, for example, in the fields of parts and services where those counterparts are extremely active. Also, Automated Driving requires more inter-industry and industry-academia collaboration and a greater understanding of users than conventional automotive technologies. Therefore, strategic actions should be taken by parties concerned so that Japan can lead the world in this field.

In the Japanese Government's "Growth Strategy 2017" (June 9, 2017)[1] and the "Public-Private ITS Initiatives/Roadmaps 2017" (May 30, 2017)[2] , discussions were held on realizing Automated Driving

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1 Prime Minister's Office, the Headquarters for Japan's Economic Revitalization "Growth Strategy 2017" (whole version)
https://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/miraitousi2017_t.pdf/ has the following description.

"I Strategic fields aiming for the achievement of Society 5.0, 2. Further sophistication of mobility services, elimination of "Mobility vulnerable people", realization of logistics revolution"

Regarding the movement of people and goods, Japan is facing a full-scale decline in population with, particularly, expected declines in its production-age population. Amid the situation, sustaining regional public transportation networks, addressing the increasingly serious labor shortage in the logistics field, reducing traffic accidents and other issues are urgent challenges that Japan must work on. In order to strengthen the nation's industrial competitiveness and address these social issues at the same time, the government will proactively advance initiatives, including institutional development, technological development, and demonstration environment development, with clear deadlines therefor, while visualizing specific business models, aiming at realizing mobility services that utilize unmanned automated driving technology ahead of the rest of the world and incorporate such services into society.

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2 Prime Minister's Office Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society, Strategic Conference for the Advancement of Public and Private Sector Data Utilization
"Public-Private ITS Initiative/Roadmaps 2017"
https://www.kantei.go.jp/jp/singi/it2/kettei/pdf/20170530/roadmap.pdf has the following description.

<Social Impact of Automated Driving Systems>

While automated driving systems are not expected to readily become common, they are expected to spread rapidly over the coming ten to twenty years and have a significant impact on society. Specifically, driving via automated driving systems is generally safer and more efficient than when humans drive; therefore, these systems can significantly contribute to solving issues faced by a society with conventional traffic systems, such as by reducing traffic accidents, alleviating traffic congestion, and lessening environmental loads.

Moreover, in addition to solving those issues, automated driving systems can drastically reduce the burden of driving placed on drivers. In particular, sophisticated automated driving systems potentially provide new means for solving conventional social issues related to mobility.

The automobile-related industries, including peripheral industries, are large in size and based on highly versatile technologies that have significant ripple effects. Therefore, promoting innovation based on new automated driving technology that can solve the aforementioned issues will not only strengthen the projects in order to achieve the social goals of reducing traffic accidents, eliminating labor shortages and helping mobility vulnerable people. In particular, implementable progress schedules have been formulated for realizing “Truck Platooning” and “Mobile Service by Unmanned Automated Driving (Last Mile Automated Driving System)” to be described in “4. Demonstration Projects”.

The “Panel on Business Strategies in Automated Driving” was established by the Ministry of Economy, Trade and Industry (METI) (Director-General of the Manufacturing Industries Bureau) and the Ministry of Land, Infrastructure and Transport (MLIT) (Director-General of the Road Transport Bureau) in February 2015, with the aim of analyzing current problems and exploring necessary actions for securing Japan's competitiveness in the field of Automated Driving systems and ensuring that Japan actively contributes to solving various societal problems, such as the reduction of traffic accidents around the world[3].

The panel confirmed the actions that need to be studied by “all-Japan” collaborations of industry-academia-government [4], and, to materialize such actions, in FY 2015 and FY2016, the panel held discussions on (i) clarifying an ideal future vision for Automated Driving (Levels 2, 3 and 4) of general cars, (ii) identifying areas requiring cooperative initiatives, (iii) developing an institutional system to strategically respond to the creation of international rules (criteria and standards), and (iv) promoting industry-academia collaboration. The panel then publicized a report titled “Action Plan for Realizing Automated Driving” (March 2017)[5].

In FY2017, the panel promoted the actions based on the progress schedules determined in the “Action Plan for Realizing Automated Driving” and managed the progress thereof. The panel also established the “Working Group on Safety Evaluation Environments” under its purview and started studying safety evaluation methods based on the results of research and development produced so far[6].

The results of studies so far were compiled as the report, “Action Plan for Realizing the Automated Driving” (Version2.0). The panel will continue checking the progress of the compiled specific actions with parties concerned and, if necessary, flexibly review the actions and consider new responses. Thus, the panel will make efforts to achieve its aim of Japan actively contributing to the development of

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competitiveness of the automobile industry and create new industries, but will also have a significant impact on various industries through improved efficiency and innovation in mobility/logistics and promote the application of automated driving technology to other fields related to automated driving technology (agriculture and mining).

The “Public-Private ITS Initiative/Roadmaps” will be revised in FY2017 and the revised version will be usually decided around June of that year.

3 Since the first meeting held in February 2015, the panel continued the discussions and published an “Interim Report” (June 2015), “Next Action Plan” (March 2016) and “Action Plan for Realizing Automated Driving” (March 2017). (See “Development of Studies”.)

4 The panel’s basic direction was confirmed in the “Interim Report”, which included the sharing of its ideal future vision of Automated Driving among those concerned, strategic separation of competitive areas from cooperative areas in developing Automated Driving technologies and formulating the Next Action Plan, promotion of strategic initiatives concerning international rules (criteria and standards) as the basis for cooperation, and promotion of industry-academia collaboration.

5 The “Future Vision Study WG” was established to study [1] and [2].

6 The progress schedule was managed by establishing the “Informal Follow-up” meeting under the “Panel on Business Strategies in Automated Driving”.

Automated Driving[7].

This report (Version2.0) was compiled after studying technologies on the vehicle side and discussions with automobile manufacturers and suppliers. Therefore, considerations are separately required from the institution and infrastructure side and for finding businesses that actually provide distribution and mobile services using Automated Driving technologies.

Also, the definition of "Automated Driving level" used in this report (Version2) is based on the definition [8] of the six stages (L0 to L5) of JASO TP-18004 (issued on February 1, 2018) adopted for the "Public-Private ITS Initiatives/Roadmaps 2017" and issued by the Society of Automotive Engineers of Japan (Table 1).

Table 1: Definition of Automated Driving Level

Level	Outline	Monitoring and responding entity concerning safe driving
Human driver monitors all or partial aspects of the driving task.		
Level 0 No Automation	• Full-time performance by the human driver of all aspects of the driving task	Human driver
Level 1 Driver Assistance	• Execution by a driver assistance system of subtasks of the driving task concerning either steering or acceleration/deceleration	Human driver
SAE level 2 Partial Automation	• Execution by a driver assistance system of subtasks of the driving task concerning both steering and acceleration/deceleration	Human driver
Automated driving system monitors all aspects of the driving task		
Level 3 Conditional Automation	• Performance by an automated driving system of all aspects of the driving task (within the limited area*) • With the expectation that the human driver will respond appropriately to a request to intervene if it is difficult for the system to continue the performance	System (Human driver if it is difficult for the system to continue the performance)
Level 4 High Automation	• Performance by an automated driving system of all aspects of the driving task (within the limited area*) • Even if it is difficult for the system to continue the performance, the user is not expected to respond	System
Level 5 Full Automation	• Performance by an automated driving system of all aspects of the driving task (not within the limited area*) • Even if it is difficult for the system to continue the performance, the user[9] is not expected to respond	System

* The term "area" here is not necessarily limited to a geographical area but includes environments, traffic conditions, speed, temporal conditions, etc.

7 On March 18, 2018 in Arizona of the United States, a self-driving vehicle developed by Uber of the U.S. hit and killed a pedestrian crossing a road during a demonstration experiment. While numerous demonstration experiments are conducted in Japan, it is important to establish appropriate rules for Automated Driving by assessing future technological development and giving the top priority to safety.

8 J3061 (September 2016) of SAE (Society of Automotive Engineers) International was translated into Japanese.

9 The "user" used here is based on the definition of SAE International J3016 (2016), which includes a driver.

<Connected Industries Automated Driving Subcommittee>

In FY2017, in addition to the conventional framework of the Panel on Business Strategies in Automated Driving, the "Connected Industries Automated Driving Subcommittee" was additionally established to promote "Connected Industries"[10], a new concept framework in which industries will create new added-values and find solutions to various problems in society by connecting various facets of modern life. In particular, the subcommittee studied ways to strengthen and accelerate actions by focusing on (1) data collection and utilization, (2) development of AI systems, and (3) strengthening human resource development.

2. Future Automated Driving (Levels 2, 3 and 4) of General Cars

The methods and timeframe for realizing Automated Driving differ between Private Cars, for which the driver can determine driving areas and methods, and Cars for Business Use (Mobile and Distribution Service) in limited areas where a company can control driving areas and conditions[11].

To achieve Level 4, development should be promoted both in terms of "technologies" and "commercialization" while supplementing technologies with institutions and infrastructure, beginning with simple scenes and advancing to more complicated scenarios, with the aim of achieving the highest level in the world in this field. To that end, it is important how performance on the vehicle side can exceed the complexity of the driving environment. Therefore, the complexity of the driving environment and the performance of hardware and software need to be categorized and indexed, and based on their combination, the areas should be extracted and necessary performance should be defined.

As to the feasibility and timeframe of Level 3 and higher, further legal and technological discussions are required, therefore the description was made as reference[12].

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10 "Connected Industries" were advocated in March 2017 when Hiroshige Seko, Minister of Economy, Trade and Industry, held a meeting in Hannover, the Federal Republic of Germany, with H.E. Ms. Brigitte Zypries, Minister for Economics and Energy, Germany, and both sides concluded the Hannover Declaration, stipulating a Japan-Germany cooperation framework concerning the Fourth Industrial Revolution.
< Hannover Declaration>http://www.meti.go.jp/press/2016/03/20170320002/20170320001.html。
<"Connected Industries" Outline>
http://www.meti.go.jp/press/2017/10/20171002012/20171002012.html

11 Unlike private cars, if personal expenses can be reduced to relax the restrictions on costs, Automated Driving cars for business use (mobile and distribution service) can be equipped with numerous sensors, and, even if the driving environment is unfavorable such as rain coming down, the driving method can be improved by providing a driver. Also, since the business providing the service can control the driving conditions, it can accumulate the driving results of the vehicles provided as a service. Meanwhile, private cars are owned by individuals and handling of vehicle data requires consideration. Therefore, the use of data accumulated for cars for business use can be considered for developing Automated Driving technologies.

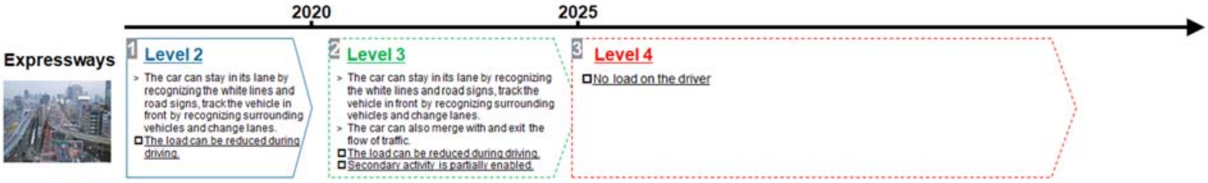
12 The establishment of a legal framework is a prerequisite for realizing Level 3 or higher. Also, the improvement of social acceptability is required.

(1) Private cars

1) Automated Driving on Expressways

On expressways, Level 2 that allows acceleration/deceleration and lane changing will be realized by 2020 on conditions that the driver monitors safe driving and can operate the vehicle at any time. After 2020, advanced Automated Driving including Level 3 is expected to be realized.

<Ideal future vision>



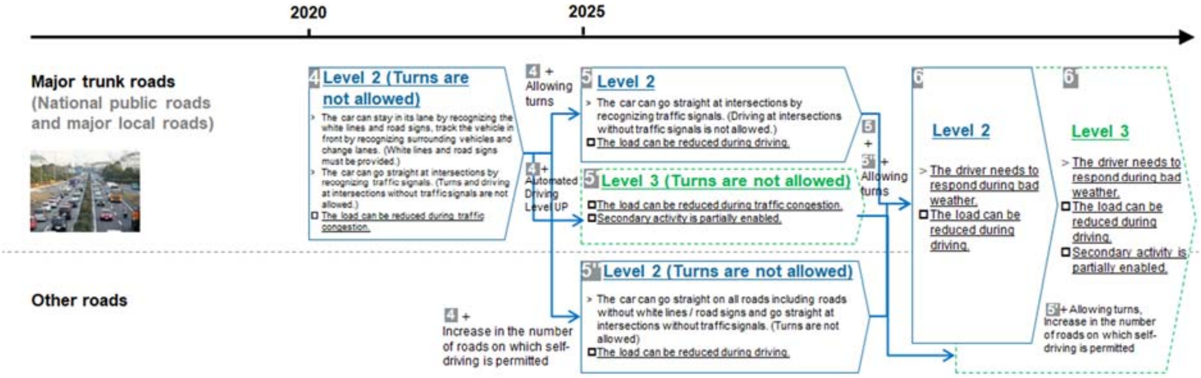
2) Automated Driving on General Roads

The straight driving of Level 2 will be realized on major trunk roads (national public roads and major local roads) around 2020.

Around 2025, the environment targeted for Level 2 will be expanded to allowing turns on major trunk roads and straight driving on other roads. On some well-developed major trunk roads, Level 3 straight driving may be realized where the system monitors safety driving and performs driving operation, and partial secondary activity by the driver [13] is allowed as long as the system can continue the operation. However, in Level 3, it is expected that the driver will respond appropriately to the system's request to intervene if it is difficult for the system to continue operation.

Afterwards, it is expected that Level 2 will be realized on all roads and that the number of roads and vehicles for which self-driving is permitted on Level 3 that allows partial secondary activity will increase.

<Ideal future vision>

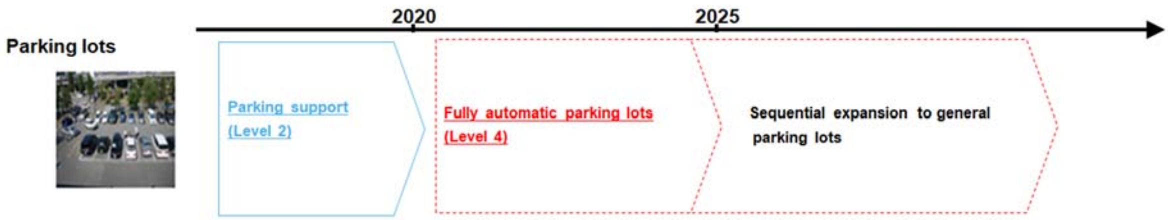


13 The words “second task” used in the “Action Plan for Realizing Automated Driving” were changed to “secondary activity” following the discussions in the United Nations. “Secondary activity” refers to acts other than driving.

As for parking, parking support (Level 2) will be realized by 2020.

Around 2020, fully automatic parking in exclusive parking lots with well-developed infrastructure will be realized. The use of fully automatic parking functions are expected to be sequentially expanded to general parking lots.

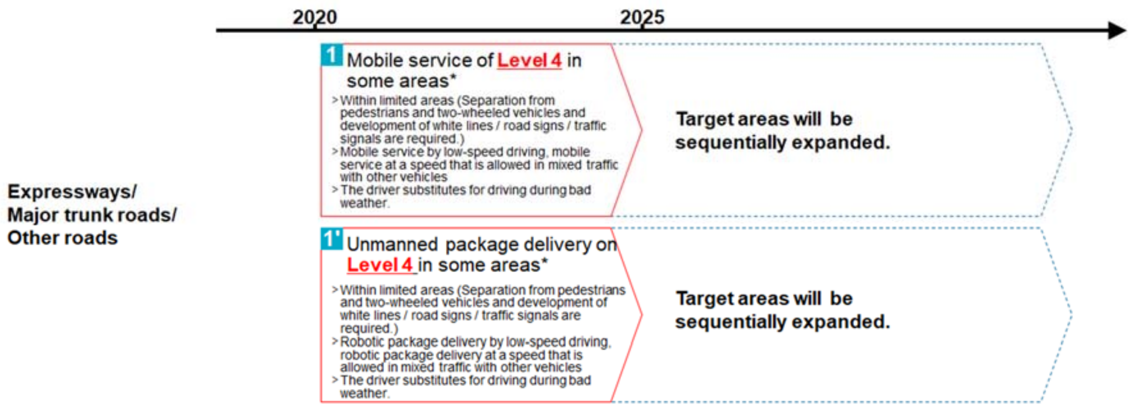
<Ideal future vision>



(2) Cars for Business Use (Mobile and Distribution Service)

Around 2020, in areas where there are strong social needs and economic efficiency can be easily established, infrastructure required in those areas can be developed together with the establishment of a legal framework. Under such circumstances, Level 4 will be realized in mobile services of low-speed driving and unmanned delivery services, whose technologies can be relatively easily realized, as well as in mobile services and unmanned delivery services at a speed that is allowed in mixed traffic with other vehicles in cities by considering the business feasibility. The areas where those services will be introduced are expected to increase with an expansion of the size and number of areas where Level 4 is enabled.

<Ideal future vision>



*Mobile services of Levels 2 and 3 and unmanned package delivery are expected to be realized.

Reference 1: Ideal Future Vision of Automated Driving and Recent Specific Trends Overseas

European and American automobile manufacturers aim to realize Automated Driving not only centering on private cars but also targeting cars for business use in cooperation with service businesses.

European manufacturers aim to realize Automated Driving using infrastructure, while American manufacturers aim to realize Automated Driving as soon as possible in specific areas by prioritizing automotive technologies.

Like Japan, there are movements to use Automated Driving that bring into view the provision of mobility services by new players including the IT industry.

<German companies>

● **BMW**

- BMW aims to introduce Automated Driving from expressways and parking lots and then on general roads by developing V2I centering on urban areas where accidents and traffic congestion frequently occur. As a precondition, BMW will enhance travelling accuracy and social acceptance, and spread Automated Driving starting from limited areas.
- Specifically, BMW announced that it will market Automated Driving cars called “iNEXT” by 2021. They are promoting technological development by entering into the “iNEXT” partnership with companies such as Intel, Mobileye, Delphi and Continental. In March 2017, BMW announced its tie-up with non-life insurance company Allianz; the automobile manufacturer and insurance company plan to jointly investigate causalities and responsibilities when accidents occur. BMW announced it will conduct a test using a total of 40 Automated Driving cars based on its 7 Series on public roads in Munich in the latter half of 2017. And, in December 2017, BMW announced it will newly construct an automobile performance test station in Czech as a research and development center of cutting-edge technologies including motorization, digitization, Automated Driving and advanced driver support systems. In February 2018, BMW released a prototype of a Level 5 fully Automated Driving car.

● **Daimler**

- Daimler aims to introduce Level 4 after 2020 with the intension of creating a society with zero accidents. However, Daimler estimates it is difficult to introduce Automated Driving, as well as allow turning on general roads before 2030. As a precondition, Daimler will promote security and safety for customers and the government by technological improvement and infrastructure development. Afterwards, Daimler plans to realize high-level Automated Driving by developing a legal framework and V2I.
- Specifically, Daimler basically continues to expand driving assistance functions and plans to develop Levels 4 and 5 through a partnership with Bosch. In January 2017, Daimler announced a tie-up with Uber for supplying Automated Driving cars and business operation of vehicle dispatch services. In April 2017, Daimler announced a tie-up with Bosch aimed at launching

"self-driving taxis that can run in urban areas on markets by the early 2020s". In November 2017, Daimler's subsidiary car2go announced the start of preparations for realizing car-sharing using Automated Driving EV in urban areas. Thus, the company has been accelerating activities for mobility service. Also, in October 2017, Daimler started demonstration tests using Automated Driving snow removal vehicles at a German airport.

● **Audi**

- Audi will introduce Levels 2 and 3 on expressways and in parking so that the company can take responsibility by itself for the safety in the case of Automated Driving of Level 3 or more. Next, Audi will introduce Level 4 in limited areas for business and assumes the deployment to general consumers afterwards. As a precondition, Audi will improve technology relating to safety and introduce Automated Driving cars on expressways in Germany for which a legal framework can be established. Afterwards, Audi plans to expand target customers and areas in accordance with the extension of a legal framework and the development of infrastructure.
- Specifically, in October 2017, Audi launched the A8 as the first Automated Driving car in the world that can perform Level 3 driving under certain conditions (although the Level 3 function cannot be used until safety standards are established). At the NIPS (Neural Information Processing System) conference held in December 2017, Audi reported research on a monocular camera that can create extremely precise 3D environmental models using AI, hence they are promoting the development of technology for comprehending the conditions surrounding vehicles more accurately.

<American companies>

● **Ford**

- Ford will introduce Automated Driving cars for business use, for which there is large demand, by selecting areas where infrastructure has been developed and the legal framework and safety can be established, to gain the initiative. As a precondition, Ford plans to establish in-vehicle technology relating to Automated Driving and introduce cars for business use in areas where safety can be secured and laws revised as soon as possible. Afterwards, Ford aims to form public opinions based on the results of demonstration tests and revise laws at an early stage.
- Specifically, Ford announced it will invest in the development of 3D maps, LiDAR, image processing and algorithms such as deep learning, and plans to commercialize Automated Driving cars jointly with Lyft. In February 2018, Ford announced the start of demonstration tests of delivery services using Automated Driving cars as a precursor to deliveries by Domino Pizza and Postmates, a start-up food home delivery service. Moreover, Ford announced it will start commercial production of fully Automated Driving cars without steering wheels and accelerators by 2021.

● **GM**

- In March 2016, GM purchased Cruise Automation, an American automated driving-related venture. In August 2017, the affiliated Cruise Automation implemented a pilot program of application-based service for making roundtrips via Automated Driving cars. In September 2017, Cruise Automation announced it had developed a system for mass-producing Automated Driving cars that are fully equipped with devices required for full Automated Driving. The company is only waiting for the solution to problems concerning software and regulations. In October 2017, Cruise Automation announced it will conduct a Level 4 test in New York in early 2018. Also, in October 2017, the company announced that the number of Automated Driving cars registered in California exceeded 100.

- In addition, in January 2018, Cruise Automation announced it had applied to the NHTSA for permission to operate Automated Driving Level 4 cars without pedals and steering wheels, and is scheduled to start commercial production in 2019.

● **FCA**

- In May 2016, FCA announced it will enter a tie-up with American company Google's holding company Alphabet (currently Waymo), to develop Automated Driving cars with vehicles supplied by FCA. Also, in August 2017, FCA announced it will participate in the Automated Driving platform that has been jointly developed by BMW and Intel, Mobileye, Delphi Automotive, and Continental.

● **Google**

- Google has selected areas where a legal framework and safety can be established and Automated Driving introduced at an early stage. With the advantages of data accumulation, Google intends to achieve speedy technical advancement. As a precondition, Google will establish in-vehicle technologies and introduce Automated Driving cars in safe areas where legal permission can be obtained. Afterwards, Google intends as quickly as possible to form public opinions and revise laws based on the results of demonstrations that show how users actually feel about the effects. While continuing the development of Automated Driving as its own technologies, Google is promoting tie-ups by taking the feasibility of launching cars on the market into consideration.
- Specifically, Google has already ordered 1,000 units of Chrysler’s minivans assuming the use for Automated Driving ridesharing vehicles. Google has already supplied 500 units to Waymo and announced in May 2017 that the minivans have covered more than 3 million miles accumulative. In June 2017, Google announced that it will conduct a public road test with 600 units within the year. In November 2017, Google's CEO said the company will start driverless ridesharing services several months later. In January 2018, Google started testing Automated Driving in Atlanta.

● **TESLA**

- In July 2017, TESLA started selling the Model 3. The hardware for using Automated Driving functions can be purchased starting at 5,000 USD, and future upgrades are expected to allow full Automated Driving. In December 2017, TESLA announced that it will strengthen their internal manufacture of AI chips.

● **UBER**

- In September 2016, UBER experimentally started a vehicle dispatch service using Automated Driving cars in Pittsburgh, and also started a test in Arizona and California in March 2017. In January 2018, UBER announced that it will adopt the technology of NVIDIA for its Automated Driving system.

● **Lyft**

- In June 2017, Lyfit announced that it will aim an experimental start of a vehicle dispatch service using Automated Driving cars in Boston in cooperation with nuTonomy, a software company. In September 2017, Lyfit announced a tie-up with Drive.al so that it can make cars automatically run on roads in San Francisco. Also, in January 2018, Lyft announced that it will aim to operate fully Automated Driving taxis in Las Vegas jointly with Aptiv.

● **nuTonomy**[14]

- In August 2017, nuTonomy announced that it will aim to commercialize vehicle dispatch services using Automated Driving cars in Singapore in 2018.

<French companies>

● **Navya**

- In June 2017, Navya conducted test-drives of an Automated Driving shuttle bus in Paris. It also started the test operation in Las Vegas in November 2017. Navya also publicized an Automated Driving shuttle bus at the CES in 2018. Also, Navya started the operation of an Automated Driving shuttle bus in Sion in south-eastern Switzerland in June 2016, where the demonstration tests had been conducted in mixed traffic with pedestrians and other vehicles.

● **Easymile**

- In July 2017, Easymile received investment from German company Continental with the aim to develop cutting-edge driverless vehicles to explore new performance fields. In October 2017, Easymile introduced Automated Driving buses in Germany. In December 2017, Easymile announced a tie-up aimed at technological development for Automated Driving buses with IVECO, Sctor, Transpoil, ISAE-SUPAERO, Ifsttar, Inria, and Michelin.

<Chinese companies>

● **SAIC (Shanghai Automotive Industry Corporation)**

- In June 2017, SAIC acquired permission to conduct Automated Driving tests in California. In January 2018, SAIC announced a tie-up with DeepMap for high-resolution maps.

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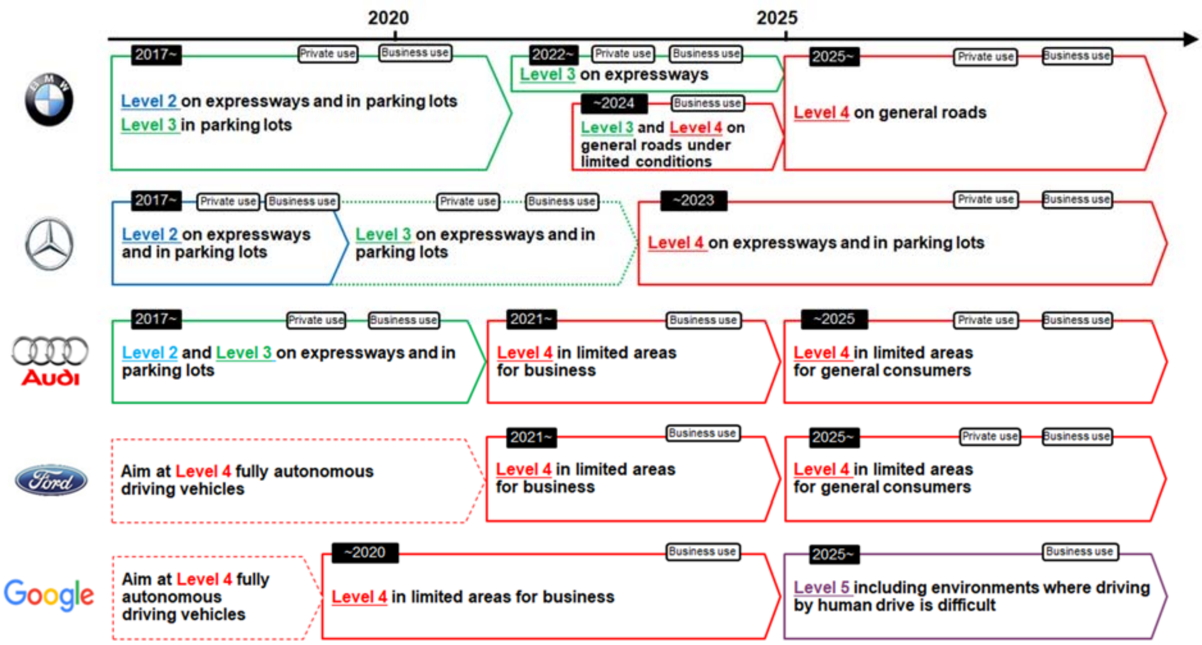
[14] nuTonomy was purchased by American company Delphi in October 2017.

● **Baidu**

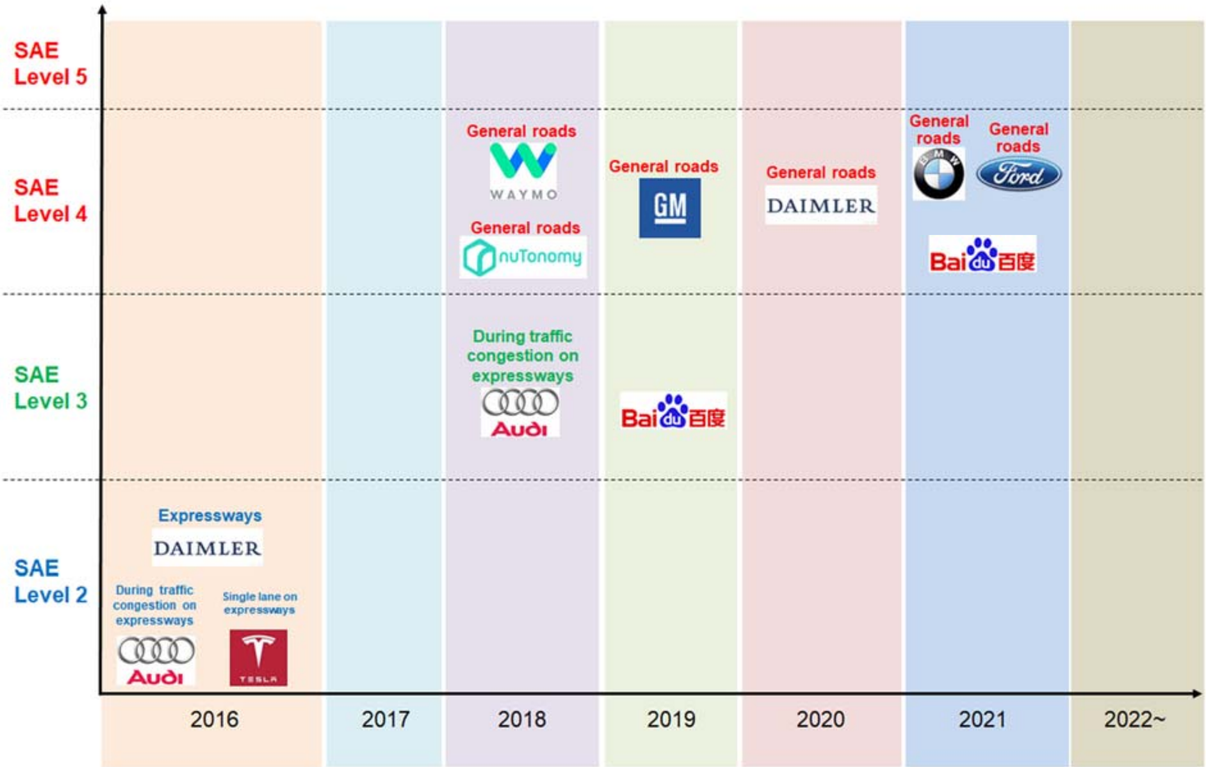
- Baidu plans to start mass-production of Level 4 Automated Driving cars jointly with BAIC (Beijing Automotive Group) by 2021. Baidu and BAIC plan to manufacture vehicles with Level 3 functions by 2019 and move to Level 4 by 2021. Under the cooperation plan, Baidu will provide image recognition, cyber security, and Automated Driving technology, and BAIC will integrate those technologies to its vehicles. It is expected that Baidu's technologies will be installed in more than 1 million BAIC vehicles by 2019.

● **Pony.ai**

- Pony.ai was established in 2016. Pony.ai acquired driving test permission in California, U.S. in June 2017. Pony.ai is scheduled to start providing trial Automated Driving services for the general public using 6 vehicles in Guangzhou (Nansha) in February 2018.



*The roadmap of Google show contents as of November 2016. In December 2016, Google started promoting tie-ups for providing technologies by taking feasibility for launching onto markets into consideration.


SAE Level 5
SAE Level 4
SAE Level 3
SAE Level 2
Expressways
DAIMLER
During traffic congestion on expressways
Single lane on expressways
General roads
WAYMO
General roads
nuTonomy
During traffic congestion on expressways
General roads
GM
General roads
DAIMLER
General roads
General roads
2016
2017
2018
2019
2020
2021
2022~

Reference 2: Automated Driving including that in mixed traffic

With the aim to realize Automated Driving (Levels 4 and 5), the panel conducted studies from the perspectives of the roles that Automated Driving can play and values it can create. Specifically, the panel visualized the ideal future vision of a society where social problems concerning the environment, safety and economy have been resolved or lessened, and can be proud of the ideal world it created by innovating mobility in and around Automated Driving, and studied the lead-up process to such a society.

The panel held innovation workshops with the participation of companies and students, and promoted the process in three steps – “Future insight”, “Idea creation” and “Feedback”[15].

The created ideas, advantages of introducing Automated Driving and social values are shown below.

The panel limited the studies this time to the creation of ideas. Further discussions as to the technological possibilities are required in order to realize the ideas.

<Created Automated Driving ideas>

- Automated Driving wheelchairs: Reduced medical expenses (health maintenance)
- Medical equipment transport carts: Promoting integrated community care
- Production system linked distribution carts: Strengthening manufacturing competitiveness
- Simultaneous disaster evacuation guides: Efficient evacuation when a disaster occurs
- Substitute water supplies: Quick startup of lifelines

<Advantages of Automated Driving>

- Elimination of dangers and relief of stress
- Substitution of operations that cannot be handled by humans
- Cost reductions

<Social values>

- Support for socially vulnerable people
- Safety and security when disasters occur
- Reform of manufacturing (productivity)

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15 The specific process of the innovation workshops was as follows.

- As for “Future insight”, the participants collected trends extensively in Japan and overseas, and studied future trends. Then, the participants explored future social changes and changes in values, and created hypothesis of how society might change. Based on this hypothesis, the participants selected three themes that Automated Driving would strongly impact and for which the hypothesis could be established due to Automated Driving.
- As for “idea creation”, the participants learned about social problems through lectures by experts and document searches for each theme. Then, the participants created specific mobility ideas that contribute to solving the problems and detailed the scenario for using such mobility.
- As for “Feedback”, various companies evaluated the created mobility ideas from the perspectives of effectiveness, feasibility, business potential and expandability, and specifically discussed how to commercialize such ideas.

3. Strategic Separation of Competitive Areas from Cooperative Areas in Developing Automated Driving Technologies (Policies)

In addition to the nine priorities determined in the “Action Plan for Realizing Automated Driving” in FY2017, “Safety evaluation” discussed in the “Working Group on Safety Evaluation Environment” was added to this report (Version2.0) as a tenth priority area.

(1) Relationship of 10 Priorities

<Necessary technologies, etc.>

To realize Levels 2 to 5, it is necessary to develop [Mapping] technology that sets the destination by obtaining lane information after identifying the vehicle's position based on the information obtained by high-accuracy maps and in-vehicle sensors[16], as well as [Recognition] technology that allows the vehicle to run by recognizing the surrounding environment by way of on-vehicle sensors. At the same time, it is also necessary to develop [Information and Communication Infrastructure] technology for recognizing dead angle information when merging with the traffic flow and turning right where necessary.

For vehicle travel, it is also necessary to develop [Path Planning] technology for reading the behavior of surrounding vehicles, etc. in advance and determining that there are no obstacles.

During driving, in addition to control technologies for the accelerator, brake and steering, it is necessary to develop [Safety (Functional Safety [17], etc.)] technology that allows the vehicle system to assuredly detect troubles and ensure safety in the event of vehicle system failure, performance limitations of sensors, and erroneous operations and misuse by users. Also, because cyberattacks are a possibility, it is necessary to develop [Cyber Security] technology that allows the vehicle system to securely detect troubles and ensure safety.

Moreover, the driver is obliged to monitor the vehicle’s surroundings at Level 2 and to monitor the system so that the driver can immediately respond to a request from the system to take over driving. Therefore, to prevent the driver from dozing off, it is necessary to develop [Ergonomics] technology that allows the vehicle system to comprehend the driver's conditions.

To develop these technologies, it is necessary to establish a [Human Resources of Software Engineering] development environment that secures and fosters human resources for the needed software engineering including the core technology of cyber security. In addition, to deploy Automated Driving cars on the roads, it is necessary to increase [Social Acceptance] including where responsibilities lie. And, it is also necessary to develop [Safety Evaluation] technology for evaluating the safety of the system constituted by the integration of these technologies.

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[16] To provide redundancy, a study is underway on high-accuracy technology for specifying the vehicle's position by positioning satellites (GPS and quasi-zenith satellites).

[17] “Functional Safety” refers to safety design at the time of failure.

<Identification of Cooperative Areas>

So that Japan can be competitive in the future, ten priorities have been identified as cooperative areas [18] from themes pertaining to Automated Driving, in consideration of the aforementioned technologies that are difficult for companies to independently develop and implement in terms of resources and technology.

*10 priorities = Maps, Information and Communication infrastructure, Recognition (technology), Path planning (technology), Ergonomics, Safety (Functional Safety, etc.), Cyber security, Human resources for software engineering, Social acceptance, and Safety evaluation

Moreover, the panel extracted specific efforts where Japan should cooperate in the 10 priorities, largely from two categories – "improving the efficiency of technological development" and "fostering of clarification and acceptability of social values ".

"Improving the efficiency of technological development" can be further classified into two cooperative subjects -- asset-sharing (test facilities, database, human resources) and common development standards and evaluation methods in the development stage.

This asset-sharing includes cooperation in data development and updates of base maps, development of a database that can be used for recognition and path planning technology and its use in the private sector, use of Automated Driving test courses, and studies of ways of securing human resources for software engineering.

Common development standards and evaluation methods in the development stage includes cooperation in improving the efficiency of development and assessment methods such as expanding the application of skill standards for embedded software, model base development and evaluation, formulation of industry guidelines and mechanisms for certifying technologies provided from suppliers to manufacturers, and development of common international rules and development tools concerning safety and cyber security.

"Fostering of clarification and acceptability of social values" has cooperative areas where efforts could be made to solve problems that individual companies cannot, such as collectively presenting the social significance of Automated Driving including the clarification of the accident reduction effects, enhancing the user's understanding of Automated Driving systems, and determining where the responsibility lies in civil, criminal and administration laws.

In particular, asset-sharing requires industry-academia-government collaboration in studying what sort of data can be shared to strengthen Japan's industrial competitiveness in the future.

[18] The "Next Action Plan" positioned 8 priorities as Cooperative Areas and the "Action Plan for Realizing Automated Driving" increased the number of areas to 9 in view of increasing importance of human resources for software engineering. This report (Version2.0) added safety evaluation as a 10th priority area.

(2) Policies in Ten Priorities

The realization of the ideal future vision of Automated Driving should be accelerated by creating progress schedules based on the needs of automobile manufacturers and suppliers, and technologies on the vehicle side, and continuing and expanding existing actions where necessary. The progress of actions implemented with regard to the ten priorities need to be regularly checked; the actions should be reviewed and new approaches should be studied and flexibly executed in response to changes such as overseas trends, technological development, and the transformation of industrial structures. Also, the ten priorities are not completely independent from each other, as it is also important to recognize their relationships. Therefore, it becomes important to deal with the ten priorities by seeing the entire picture including progress of each priority field.

I. Maps

The development of high-accuracy maps used for Automated Driving requires the [1] clarification of business models (development range, specifications, cost-sharing (including determining the development entity), and update frequency), [2] technological development for cost reduction relating to data development and update, and [3] international standardization of data formats and overseas development for the global commercialization of vehicles.

(Points of cooperation)

- **Clarification of business models**
- **Cost reduction relating to map data development and update**
- **Overseas development**

<Progress and policies>

As for expressways, a direction (business model) was almost agreed to [19] in FY2016. As for general roads, it was presented in FY2017 that the development scope and specifications will be determined from demonstrations in specific areas (Tokyo 2020 demonstration areas)[20].

For practical application on expressways and demonstration in the specific areas (Tokyo 2020 demonstration areas) sometime in 2020, the arrangement of data for all expressways will be completed in FY2018 and that for general roads in the specific areas (Tokyo 2020 demonstration areas) will be completed in FY2019.

Also, it is important to decide the development policies for general roads early on in any sort of cooperative effort. Therefore, it is necessary to decide the development policies based on the

[19] As for expressways, Dynamic Map Platform Co., Ltd. (DMP) has been creating map data based on the "Recommended specifications concerning high-accuracy maps for Automated Driving" (November 2016) complied by the Automated Driving Study Committee of the Japan Automobile Manufacturers Association (JAMA). In FY2017, map data for 14,000 km of major expressways in Japan were created. Map data for 30,000 km of major expressways in Japan are scheduled to be created in FY2018.

[20] The Automated Driving demonstration areas that have been considered by the Japan Automobile Manufacturers Association (JAMA) are expected for the 2020 Tokyo Olympics and Paralympics, specifically the Haneda area, new Tokyo waterfront sub center area, and Shinjuku area.

demonstrations in the specific areas (Tokyo 2020 demonstration areas) by 2021. Moreover, it is important to continue promoting the development of automated mapping update technologies and reducing costs for expressways and general roads, respectively.

At the same time, the panel will promote international standardization of data formats and overseas development [21] to ensure compatibility with map data overseas.

Together with studies of high-accuracy maps, for creating dynamic maps with serviceability and real-time performance, it is necessary to [1] decide how to deal with dynamic information used for Automated Driving such as probe data, [2] deploy map data including high-accuracy map data to other fields besides Automated Driving to improve efficiency of cost-sharing, and [3] decide the concept and entity of dynamic map center functions for collecting and distributing data.

(Points of cooperation)

- **How to use probe data (in the Automated Driving field)**
- **Deployment of data to other fields**
- **Concept of dynamic map center functions**

<Progress and policies>

Using the results of demonstrations such as the dynamic maps from a large-scale demonstration [22] conducted in FY2017 and FY2018, the panel has been studying application methods and specifications of probe data and the concept of dynamic map center functions from FY2016 to FY2018. The clarification of the purposes of use and cooperation become important for the early development of probe data because there are many undecided matters and parts that can be handled by each company are limited [23].

II. Information and communication infrastructure

It is necessary to specify what scenes the information is required in in order to establish cooperation with regard to information and communication infrastructure. Therefore, it is necessary to [1] set cases that require dead angle information when merging with the traffic flow on expressways and turning right on general roads, [2] decide demonstration sites and necessary infrastructure and specifications such as road-vehicle communication between vehicle and infrastructure facilities, and [2] promote environmental improvements.

(Points of cooperation)

- **Setting cases of use**
- **Selecting necessary infrastructure**

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21 In North America, DMP converted sample maps based on the company's specifications into data and distributed the data to domestic and overseas OEMs and major suppliers (40km of trunk roads in the Silicon Valley area). In Europe, DMP started discussions with HERE (Germany).

22 As part of the large-scale demonstration test by the Cabinet Office SIP (Strategic Innovation Promotion Program), a demonstration using about 758 km of created base maps was conducted in FY2017. In FY2018, a test pertinent to updating the base maps and distributing dynamic information is scheduled.

23 It is necessary to reach an agreement on how to respond to accidents due to defects of maps in business model because it largely affects the costs.

<Progress and policies>

For practical application on expressways and demonstration in the specific areas (Tokyo 2020 demonstration areas) sometime around 2020, the Japan Automobile Manufacturers Association (JAMA) decided demonstration sites and routes, arranged the cases of use and necessary information, and presented them to related organizations.

As future activities, it will be necessary to set specifications and design requirements in FY2018 in cooperation with those related organizations, and develop the necessary infrastructure in the specific areas (Tokyo 2020 demonstration areas) at least within FY2019. At that time, it becomes important to study specifications, etc. for cooperative actions in consideration of cellular system technology[24] and look into using various communication technologies in order to keep up with globalization and make sure that the functions and equipment of the infrastructure do not become excessive.

III. Recognition technology, IV. Path planning technology

As for the sophistication of recognition technology and path planning technology, it is necessary to [1] sequentially establish minimum required performance criteria and their test methods in accordance with overseas trends, [2] provide test facilities and evaluation environments, and [3] create databases of sensing information including driving video data, driving behaviors and traffic accidents in order to improve development efficiency.

(Points of cooperation)

- **Establishment of minimum required performance criteria and their test methods**
- **Provision of test facilities and evaluation environments**
- **Creation of databases along application purposes**

<Progress and policies>

As for performance criteria and their test methods, the panel started a preliminary test service[25] for evaluating safety ensuring measures based on the "Guideline for Public Road Demonstration Tests of Automated Driving Systems"[26] in February 2018 by using the "Jtown"[27] Automated Driving evaluation bases established by JARI (Japan Automobile Research Institute) in March 2017. Also, as for databases, JARI is considering the creation of recognition and path planning

24 It is also necessary to develop hardware that can deal with change of frequency band.

25 The Automated Driving evaluation bases were built by reforming existing simulated city roads as a METI-subsidized project in order to solve problems in cooperative areas of Automated Driving technology and establishing future evaluation methods through industry-academia-government collaboration. http://www.jari.or.jp/tabid/142/Default.aspx

26 The National Police Agency indicated the points of attention in the guideline from the perspective of promoting traffic safety and smooth flow during public road demonstration tests to be conducted using Automated Driving systems. https://www.npa.go.jp/koutsuu/kikaku/gaideline.pdf

27 http://www.jari.or.jp/Portals/0/resource/press/Press_2018_1_15.pdf

databases[28]. JARI has already publicized sample data[29] in the form of driving videos for possible application to other industries.

As for performance criteria and test methods, the panel will sequentially study and establish test methods using the "Jtown" bases for possible introduction of Automated Driving on general roads in about 2020. Parallel to this, the panel will take into consideration international trends where the United Nations regulations on automatic steering that were studied for expressways will be applied to the standards for general roads. Also, the recognition and path planning database and traffic accident database will be used for the purpose of formulating scenario data used for the later-mentioned safety evaluations and paid for by users thereof. Moreover, the records of drive recorders can be used as proof for identifying the causes of accidents, and it is absolutely necessary to create a mechanism for preventing the risks of data rewriting and outflow.

V. Ergonomics

The driver is obliged to monitor the system at Levels 2 and 3 because the transfer of driving may occur from the system to the driver. Therefore, it is necessary to establish technology that allows the system to comprehend the driver's conditions and enhance the driver's understanding of the system. For Level 2 and higher, the interaction between the system and other traffic participants needs to be established to realize smooth with other traffic participants. It is important to promote common development and evaluation infrastructure as cooperative areas in order to improve development efficiency. Therefore, it is necessary to [1] identify driver physiological and behavioral indicators and study the requirements for driver monitoring and safe transfer of driving, [2] study ways of improving the driver's comprehension of knowledge about state of the system, and [3] study communication methods between Automated Driving cars and other traffic. Moreover, it is necessary to [4] promote international standardization based on the results of the studies of [1] to [3].

(Points of cooperation)

- **Driver monitoring requirements**
- **Driver's understanding of the system**
- **Communication method between Automated Driving cars and other traffic**
- **International standardization**

<Progress and policies>

The indicators of the driver's physiology and behavior were identified and the basic concepts of a driver monitoring system were completed by the end of FY2016. Both have been undergoing verification in a large-scale demonstration test started in FY2017 and continuing into FY2018. Also, the panel is promoting a proposal on international standardization[30] that includes

[28] The "recognition and path planning database" was created in SIP-adus, on consignment from METI, as a database for sensing data such as driving videos and driving behavior data.

[29] http://www.jari.or.jp/tabid/599/Default.aspx

[30] ISO/TR21959 Part 1 is scheduled to be issued as to inward HMI (Road Vehicles: Human Performance and State in the Context of Automated Driving: Part 1 - Terms and Definitions) in 2018. ISO/TR23049 is scheduled to be issued as to outward HMI (interaction between Automated Driving cars and other traffic

technologies under consideration such as indexing of the driver's readiness state and HMI [31] concerning the transfer of driving from the system to the driver.

By the end of FY2018, the studies of various requirements will be completed as a result of the large-scale demonstration tests, and the design basis will be established through cooperation and continuous promotion of international standardization. As for secondary activities, it is necessary to study the evaluation method of acceptable secondary activities while taking overseas trends into consideration.

VI. Safety (Functional Safety, etc.)

The panel is pursuing common development and evaluation methods to improve development efficiency relating to functional safety and thereby ensure safety. As for studies of development and evaluation methods, the panel needs to [1] formulate use case scenarios and [2] extract safety design requirements and establish their evaluation methods in the event of vehicle system failures, performance limits of sensors, etc. and misuse. Also, these design requirements need to [3] promote international harmonization.

(Points of cooperation)

- **Formulation of use case scenarios**
- **Safety design requirements and their evaluation methods**
- **International harmonization**

<Progress and policies>

In FY2017, the panel formulated use case scenarios [32], derived sensor target performances and extracted design requirements, all of which have been proposed for consideration as international standards [33].

Although it is largely related to the later-mentioned safety evaluations, in order to establish and verify methods for evaluating vehicle system failures, performance limits and misuse, the evaluation methods need to be established by creating virtual environments and simulators, and conducting demonstration using actual vehicles. As for the evaluation and certification system, JARI is expected to play a central role in creating the system, as a neutral organization that has

participants) (Road Vehicles - Ergonomic aspects of external visual communication from automated vehicles to other road users) in 2019.

31 Acronym for Human Machine Interface. HMI is classified largely into inward HMI that serves as the interface between the system and the driver (grasp of the driver's state and the transfer of driving to the driver) and outward HMI that serves as the interface between the system and other traffic participants (grasp of the behavior of other traffic participants and presentation of the behavior of the Automated Driving cars to other traffic participants.)

32 For a definition of use case scenarios, see the safety evaluation items mentioned later. Since it is difficult to ensure the completeness of use case scenarios, representative cases were extracted at this point. Therefore, these cases need to be corrected and sequentially added.

33 ISO26262 is scheduled to be issued as an international standard on functional safety in 2018, and SOTIF (ISO/PAS21448) is scheduled to be issued as an international standard on performance limits and erroneous operation and misuse of users in 2018. SOTIF (ISO/PAS21448) may be integrated with ISO26262 in the future.

knowledge of vehicle technologies and test courses for evaluating technologies, and can certainly work from the perspective of users[34].

VII. Cyber security

The panel aims to commonize development and evaluation methods in order to improve development efficiency relating to the cyber security. In studying these methods, it is necessary to [1] set the minimum required standards and [2] establish requirements, development processes and evaluation methods. Also, these design requirements need to [3] promote international harmonization. Moreover, it is necessary to [4] enhance cooperative measures by establishing an evaluation environment (testbed) for performing performance evaluation on the parts level. In addition, it is important to [5] establish a system for sharing and analyzing incident information and vulnerability information that have been generated in operations after marketing and enhance measures via industrial cooperation.

(Points of cooperation)

- **Minimum required security standards**
- **Safety design requirements and evaluation methods**
- **International harmonization**
- **Practical application of testbed (Establishment of an evaluation certification system)**
- **Establishment of a system for sharing and analyzing information in operations**

<Progress and policies>

The panel set the minimum required standards and proposed such standards for consideration as international standards [35] before the end of FY2016, and has been formulating the industry guideline [36] in Japan prior to any international standards. Also, international criteria have been discussed in terms of the connection to vehicle safety standards with active participation of the automobile industry in the Cyber Security Task Force [37] affiliated with WP29[38].

The panel will be actively engaged in discussions of international criteria and standards, and will create the testbed by the end of FY2018 and promote its practical application afterwards. As for the information-sharing system established by the Japan Automobile Manufacturers Association

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34 As part of creating the system, it is necessary to develop facilities and human resources as a collaboration base by obtaining knowledge of the automobile industry and universities in Japan and overseas, while taking international standards into consideration. Also, the system is expected to function as a place for developing human resources relating to safety, security, and software engineering.

35 ISO21434 is scheduled to be issued in 2020. The international standardization of cyber security has been promoted by the JWG (Joint Working Group) with SAE of the U.S

36 JASPAR (Japan Automotive Software Platform and Architecture) is scheduled to formulate the evaluation guideline that OEM suppliers use.

37 A task force was established in December 2016 to set the technical requirements of the guideline formulated at WP29 –"Cybersecurity and Data Protection" (agreed to at the ITS/AD session in November 2016 and established at WP29 in March 2017)

38 The World Forum for Harmonization of Vehicle Regulations (WP29) of the United Nations Economic Commission for Europe (UN-ECE).

(JAMA) [39], it is important to promote the expansion of the system as it is critical to strengthening information-sharing and analytical functions. Although they are not specialized in vehicles, the Cybersecurity Framework [40] was formulated in the USA and the Cybersecurity Certification Framework [41] will be studied in Europe. Under such circumstances, there has been movement in Japan toward studying frameworks industry by industry. Cyber security risks increase for vehicles due to the progress of Connected and Automated Driving technologies. Therefore, it is important to study a reasonable framework that the automobile industry can utilize.

Regarding the development of evaluation methods and evaluation environments, it is important toward ensuring cyber security for Automated Driving to acquire knowledge and know-how from other industries by gaining the participation of experts from the IT industry, etc.

VIII. Human resources for software engineering

There is serious shortage of human resources in Japan who can deal with both automotive engineering, which is at the core of development, and software engineering inclusive of cyber security. Therefore, it is urgent to take measures for discovering, securing and training such human resources. Specifically, it is necessary to [1] clarify an image of the human resources for software engineering and security required for the automobile industry, [2] create a mechanism for academic collaboration that can secure and train these human resources, and [3] target young people as these human resources and train them through lectures and events.

(Points of cooperation)

- **Clarification of an image of the necessary human resources**
- **Studies into creating a mechanism for inter-academia collaboration**
- **Training of young human resources**

<Progress and policies>

As for human resources for software engineering, in FY2017, the panel classified and arranged software skills for vehicles (control, intelligence, information and infrastructure systems) and conducted a survey on best practices concerning human resources for software engineering and their training, attraction and productivity improvement in Japan and overseas. In FY2018, the panel will first promote efforts to attract human resources from other industries to the automotive industry and formulate skills standards concerning automotive software by considering use of human resources development courses. Moreover, the panel will launch a human resources strategy working group (provisional name) under itself to accelerate the discussions of various

39 J-Auto-ISAC WG was established by JAMA and started operation in April 2017.

40 Version1.0 announced in February 2014 presented an overall picture of cyber security measures and categorized them into functions for “Identification”, “Protection”, “Detection”, “Response”, and “Recovery”. The discussions for formulating Version1.1 have been progressing. In this revision, “supply chain risk management” and “self-assessment of cyber security” are emphasized.

41 The Cybersecurity Certification Framework will be created and a cyber security certification system will be established in Europe for ICT equipment and services, in order to ensure the reliability and security of the digital single market in Europe. This framework is voluntary unless otherwise provided in laws and does not immediately impose regulations on businesses.

measures.

As for human resources for security, in FY2017, the IPA (Information-technology Promotion Agency) provided courses on industrial cyber security and the Society of Automotive Engineers of Japan provided courses on vehicle cyber security. These measures will be continued in FY2018. Active efforts including the discovery of overseas human resources and mid-career recruitment will be required in the future. In such case, it is essential to study employment systems for securing human resources and the automotive industry should cooperate in advertising the need of cyber security human resources at manufacturing sites and the attractive features of their jobs.

IX. Social acceptance

To raise the social acceptance of Automated Driving systems, it is necessary to [1] show the effects and risks of Automated Driving and [2] promote technological and institutional development while enhancing the awareness and interest of society and consumers. It is, therefore, important to promote development of the system according to user needs.

(Points of cooperation)

- **Messaging of effects and risks of Automated Driving**
- **Institutional development corresponding to needs including clarification of where the responsibility lies**

<Progress and policies>

Discussions about the institutional development including where the responsibility lies have been progressing in ministries and agencies. The "Outline of Institutional Development of Automated Driving"[42] that shows the policy of institutional development relevant to the entire government is scheduled to be formulated at the end of FY2017. Moreover, the Automated Driving level decided in the “Public-Private ITS Initiatives/Roadmaps 2017” (see Table 1) has been commonly recognized in public [43]. As for disseminating information for promoting the understanding of the general public, the government has continued such efforts through symposiums [44] and open

[42] Under the “Public-Private ITS Initiatives/Roadmaps 2017”, the government is scheduled to formulate its policy (framework) relating to the development of a system for realizing advanced Automated Driving with the IT Strategy Headquarters playing a central role in close collaboration with the relevant ministries and agencies by the end of FY2017. “Growth Strategy 2017” shows that “Regarding the review of traffic related laws and regulations that is necessary for the advancement of marketing and creation of advanced automated driving services in the future, the government will accelerate discussions related to institutional development in anticipation of international institutional competition, and discussions related to international treaties with the aim of marketing and creating advanced automated driving services (Level 3 or higher) that include complete automated driving by around 2020, and summarize their policy (outline) on this institutional development relevant to the entire government during this fiscal year.”

[43] It has been pointed out that the Automated Driving level is difficult to understand from the viewpoint of general consumers. Therefore, it is necessary to enhance people’s comprehension by disseminating easy-to-understand information such as categorized information based on the relationship of responsibility between the system and driver.

[44] The symposiums were held on March 7, 2017 and on March 5, 2018 under a project consigned from the METI and the Ministry of Land, Infrastructure and Transport (MLIT) titled the “Study on Civil Responsibility and Social Acceptance of Automated Driving” with the participation of the automotive industry, mobile and distribution service businesses, legal experts, insurance organizations, general

participation type events [45].

It is important that system development in the relevant ministries and agencies be accelerated based on the “Outline of Institutional Development of Automated Driving” in the future. Also, people's understanding of the Automated Driving system is essential for the practical application of Automated Driving because it is necessary to prevent misinterpretations and overconfidence by users. Therefore, effective messaging to society is becoming more important in order to accelerate and enhance comprehension. Moreover, it is necessary to quantify the effects that Automated Driving on decreasing accidents, conserving energy and reducing CO2 emissions by FY2018, in order to clarify the effects of Automated Driving and strengthen the messaging to society by FY2018.

In addition, various demonstration projects, including those to be mentioned later, by relevant ministries and agencies, and by the private sector were started in FY2017. Therefore, it is important to improve social acceptance by proactively reporting the contents of such demonstration projects and have people recognize that Automated Driving is becoming more commonplace in society.

X. Safety evaluation

WP29 has been discussing the international criteria and ISO has been discussing the international standards concerning various fields of Automated Driving, in order to realize advanced Automated Driving whose practical use is expected after 2020. Therefore, it is necessary to immediately discuss safety evaluation methods under the consideration of such criteria and standards. Accordingly, the panel established the Working Group on Safety Evaluation Environment under itself and discussed the issue with the participation of parties concerned.

Safety evaluations relating to Automated Driving systems have limitations if they are conducted using actual vehicles because the cognition, determination and operation tasks conventionally performed by the driver are performed by the system. Therefore, it is necessary to perform evaluations on virtual simulations, and for such simulations, [1] scenarios for safety evaluation[46], [2] data collection required for creating the scenarios in (i), and [3] research into cases of use[47] will be required.

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consumers, etc.

45 SIP-adus held several rounds of discussion with the participation of citizens. In addition, SIP holds workshops every year.

46 A scenario describes from the beginning to the end of a sequence of actions (operations). Also, a scene describes a snapshot in a sequence of actions (operations). Germany's PEGASUS project defines three kinds of scenarios - Functional Scenario, Logical Scenario, and Concrete Scenario.
Functional Scenario: Refers to elements of the traffic environment when the vehicle runs.
Logical Scenario: Refers to the definition of parameter ranges of elements.
Concrete Scenario: Refers to a scenario with one fixed parameter for the specified elements, to be used in testing.
There are similar classifications for Scenes.

47 Cases of use correspond to the Logical Scenes of Germany's PEGASUS project.

(Points of cooperation)

- **Scenarios**
- **Mechanism of data collection**
- **Cases of use**

<Progress and policies>

The Japan Automobile Manufacturers Association (JAMA) and JARI (see “VI. Safety”) have been arranging cases of use in cooperation with each other since FY2016, and the panel will use such cases. As for data, the panel will create provisional scenarios by the end of 2018 by using the recognition and path planning database and traffic accident database (see “III. Recognition technology, IV. Path planning technology”).

As for safety evaluations, it is necessary to promote international harmonization [48]. Therefore, to promote opinion exchanges with overseas study groups, the panel will extract cases of use that show typical traffic conditions in Japan to use for such exchanges.

In the future, while promoting the formulation of scenarios and international harmonization, it is also necessary to create tools [49] for performing virtual simulation and study how to share scenario data concerning accidents and incidents [50] that occur in operations. Also, the panel will arrange [51] safety requirements that vehicles with advanced Automated Driving systems need to meet and measures for ensuring safety.

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48 As described in “5.Stragetic Initiatives Concerning Rules (Criteria and Standards)”, international vehicle safety standards have been formulated in the intergovernmental meeting (WP29) of the United Nations Economic Commission for Europe (UN-ECE). Since Japan has actively participated in the meeting as an international harmonization activity, it is necessary to promote international harmonization of scenarios by taking the safety standards into consideration.

49 Assumed tools are [1] those for extracting scenarios from databases and [2] those for converting the scenarios extracted in [1] to the evaluation environment (simulator) of each company.

50 In this report (Version2.0), “incidents” refer to near misses that do not lead to accidents.

51 Safety requirements that vehicles with advanced Automated Driving systems need to meet and measures for ensuring safety are scheduled to be formulated as a guideline in summer of 2018 by the “Automated Driving Vehicles Safety Measures Working Group” established under the Vehicle Safety Measures Study Panel of the MLIT in January 2018.

Reference 3: Basic policy on strategic collection and utilization of driving video data and accident data

1. Purposes

With the aim to drastically strengthen the competitiveness of recognition and path planning technology, which are key technologies of Automated Diving, the panel will formulate a basic policy on strategic collection and use of driving video data and accident data from the perspective of accelerating research and development and promoting development and utilization of high-quality data related to safety evaluation.

2. Driving video data

(1) Driving video data

In a project commissioned by the Japanese government, JARI plans to establish database creation technology for sharing and applying video data of pedestrians required for the development and performance evaluation of the recognition system using cameras. For that purpose, JARI created a video database of pedestrians totaling about 1,500 hours of footage, 4.2PB and 140,000 scenes, and a video database collected when vehicles run for specific purposes.

(2) Basic policy of strategic collection and utilization

1) Strategic collection

The panel will use the 1,500 hours of driving video data that has been already obtained. If driving video data are required for new purposes, the panel will collect such data where necessary, after sufficiently considering the specific methods of use, for example, for a project commissioned by METI. When actually collecting such data, it is necessary to sufficiently study in advance;

A) requirements concerning the number of pixels, angle of view, photographing positions, and collection spots required for driving video data for creating scenarios, and;

b) how the relevant driving video data will be managed and used once obtained.

Specifically, in FY2018, the panel will start obtaining driving video data required for creating scenarios used for studying and developing safety evaluation technology.

2) Basic policy of utilization

i) Application to AI development, etc.

In order to expand the range of new technology research such as AI development, the panel made available free sample data (9 scenes) in January 2018 and held explanations assuming that not only companies but also universities and research institutes use driving video data for machine learning or deep learning. In addition, on condition that certain requirements such non-disclosure agreement are met, JARI started offering sample data of 288 scenes selected by the industry-academia-government committee of experts for a nominal charge (bearing only actual expenses), as a voluntary project, in March.

In the future, JARI will individually consult with those who require the use of the driving video database, such as those who purchase the 288 scenes of sample data, and promote application to AI development via a cost-sharing approach in principle.

ii) Application to development and studies of safety evaluation technology

It is urgently required to study and develop safety evaluation technology required for introducing Automated Driving cars onto markets. As for safety evaluations, it has been globally presented that not only evaluations on actual vehicles but also driving simulations should be conducted. After FY2018, the panel will obtain new purpose-specific driving video data when creating scenarios for studying and developing safety evaluation technology. For example, the panel will [1] apply such data to pedestrian models and use it to [2] extract near misses and scenes that lead to near misses.

3. Accident data

(1) Accident data

If cooperation can be obtained from the parties involved when a traffic accident has occurred, accident data can be used to reproduce accident scenes by simulation from the stories of those involved in the accident, 3D data of accident scenes and video at the time of the accident. In a three-year project from FY2016 to FY2018 commissioned by the government, a research and development group that includes Denso and the Institute for Traffic Accident Research and Data Analysis has been developing a data collection method and technology for creating an accident database.

(2) Basic policy of strategic collection and utilization

1) Strategic collection

The panel collected the data of 11 accidents that occurred in FY2017 in the target Tokyo Metropolitan area. The panel will continue collecting data with the aim of collecting data from 20 or more accidents in FY2018.

2) Basic policy of utilization

i) Application by automobile manufacturers, etc.

So that automobile manufacturers can use an accident database to design, develop and verify Automated Driving cars, the panel will continue collecting accident data and developing database technology with the aim of commercializing the database in FY2019 at the earliest.

ii) Application to studying and developing safety evaluation technology

It is urgently required to study and develop safety evaluation technology required for introducing Automated Driving cars onto markets. As for safety evaluations, it has been globally presented that not only evaluations on actual vehicles but also driving simulations should be conducted. After FY2018, the panel will need to take accident data into consideration when creating scenarios for studying and developing safety evaluation technology, and will study possible application methods.

Reference 4: Competitive and cooperative areas of Automated Driving of overseas manufacturers

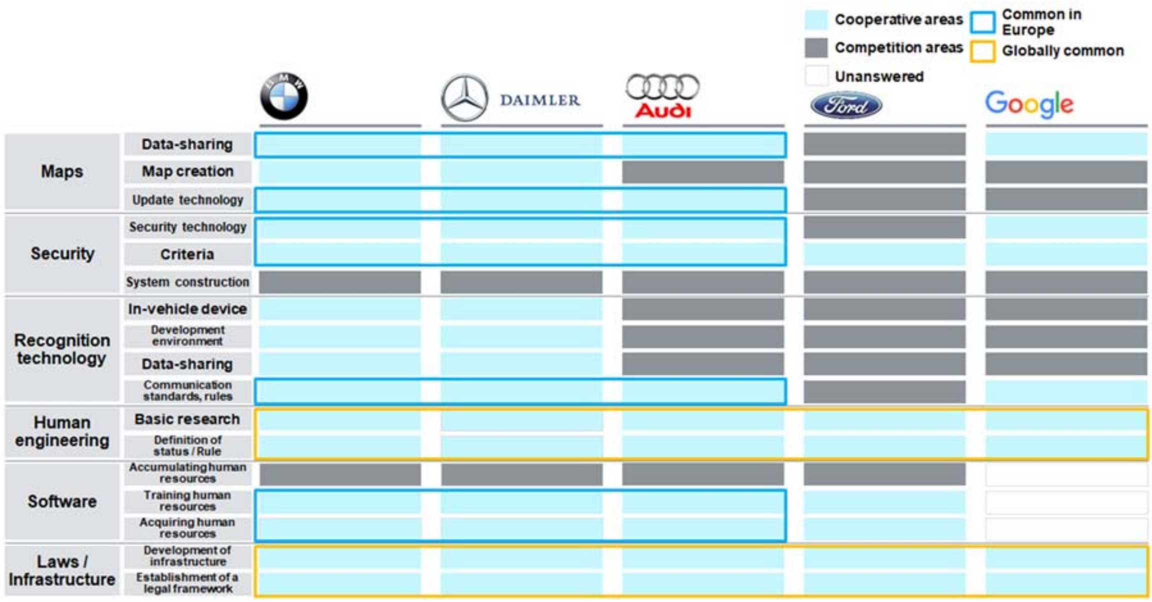
Automobile manufacturers are cooperating in research of globally-common ergonomics and law / infrastructure development. Moreover, European manufacturers are also promoting cooperation in maps and human resources for software engineering. If themes relating to Automated Driving are classified, it is found that European manufacturers are promoting cooperation particularly on themes of high development man-hours and costs regardless of the degree of difficulty of technology and efforts.

<**Germany**>

- Placing top priority on safety, BMW is actively promoting cooperation in areas that are difficult to deal with by one company alone, data-sharing because of the shortage in terms of resources, and basic research.
- Giving top priority to the safety of users, Daimler is promoting cooperation focused on themes related to eliminating accidents.
- Audi conducts cooperation aimed at reducing the initial costs of launching projects and, after that, will direct other cooperative efforts at reducing running costs. Moreover, Audi is also promoting collaboration in ensuring user safety as the basis for realizing Automated Driving as soon as possible. in addition to cooperation regarding costs.

<**USA**>

- Ford only cooperates with other automobile manufacturers in establishing a legal framework for Automated Driving and revising laws as soon as possible. Ford basically considers all technological development as competitive areas.
- Google has cooperated in data areas, which is its strength, for ensuring user safety and speedily introducing Automated Driving. Moreover, in view of launching Automated Driving cars onto markets as soon as possible, Google has started working with other companies by providing technologies parallel to its own development.



Reference 5: Development mechanisms in cooperative areas in Germany

(1) Background for cooperation

The cooperative efforts in Germany have been historically cultivated affront a background of need to unify steps among states and companies under the federal system and among countries in Europe. German manufacturers have learned how to cooperate for years at a time through projects in Europe and Germany.

(2) Global cooperation strategy in Germany

Germany basically solidifies concepts in its national projects by excluding other countries and, paired with that, forms partnerships via mirror projects in Europe. However, it seems that Germany has approached China to form cooperative programs. Therefore, it is possible for foreign manufacturers to be "insiders" if they can contribute to German companies.

Looking at the “science >> technology >> market” phases of the product development process, France leads in science as shown in the fields of mathematics, nuclear power and aviation; Germany does not necessarily have an advantage. However, in the "technology" phase that serves as a bridge to "market" in competitive areas, Germany has skillfully utilized consortiums to absorb knowledge from France and turn technology into business.

(3) Points for making cooperation a success

German manufacturers have the basic mindset of presenting a vision for realizing ideal future images in cooperative areas and mounting technologies onto vehicles in competitive areas. First, they advocate a vision and cause (better society) that nobody can object to and thoroughly discuss it on a vision level. However, since it is impossible to unify the intensions of all concerned parties, they are willing to work within a framework that embraces the expectations of all companies. Then, each company selects and starts actual development from what they can do. Therefore, it behooves the participants not to take the defined framework too seriously,

In such efforts, the “leaders of the cooperative areas” where cooperative areas for OEM and Tier 1 companies become competitive areas for an automobile company have started up. For example, “leaders of the cooperative areas" include academia, certification organizations, engineering companies and tool venders. Such "leaders of the cooperative areas" take a neutral stance and play a coordinating role by arranging relationships and responsibilities among stakeholders.

In cooperative areas, there are vertical type projects for developing functions to be mounted to specific things in a milestone and horizontal type projects for developing methodologies where methods continue to evolve along a temporal axis. Ko-HAF, which targets functional demonstration of Level 3 on expressways, is considered a vertical type project and PEGASUS, which targets the formulation of safety evaluation frame of Automated Driving, is considered a horizontal type project.

(4) Strength of business-academia collaboration in Germany

In business-academia collaboration projects in Germany, doctoral students act as project managers and get ideas for their theses from the industrial world, while obtaining the experience of working for companies. It is considered a prerequisite for becoming a professor that students join the business world after completing their doctoral course and assume a directorial position after acquiring about 10 years of business experience, before returning to university. Based on such experiences, researchers at German universities play the role of promoting activities in cooperative areas by having personal connections in industry and a business sense.

(5) Benefits enjoyed by OEM companies and suppliers from cooperation

If cooperative areas are set, OEM companies and suppliers benefit from the efficiency improvements and the right to speak up.

First, OEM companies and suppliers benefit from the fact that development target are clear. If the criteria that Automated Driving cars should meet is clarified in advance, it eliminates waste in development and prevents the need for reworking things. Therefore, if OEM companies and suppliers do not participate in discussions for cooperative projects, there is an increasing possibility of excessive development

Also, OEM companies and suppliers can spread out the tasks and costs of development by conducting technological development related to the Automated Driving in cooperation with others. They look at technological development relating to Automated Driving as inefficient for one company to do by itself because the number of areas that should be considered is large compared with conventional technology development. Spreading out the tasks and costs allows them to concentrate investment in competitive areas.

To realize Automated Driving, it is necessary to establish new rules and standards. As a part of that process, rather than one company lobbying the government, if the entire industry speaks out, it can exert greater influence.

Another objective of the group approach is to take responsibility as an industry if an accident occurs. The thinking here is that one company alone should not take responsibility in new fields.

Reference 6: Automated Driving-related efforts in Germany centering on PEGASUS

The PEGASUS project in Germany began in January 2016 and will continue until September 2019 with the principal purpose of defining Automated Driving concepts and an evaluation framework therefor. Three OEM companies (Daimler, BMW, VW) in Germany, which require the support of safety evaluations before launching Automated Driving cars onto markets, and certification organization TUV played a central role in starting the project. The scope of the project is to create a general framework for all kinds of Automated Driving levels and road environments. However, the project has for the time being focused on SAE Level 3 on expressways. In the interim report issued in November 2017, the evaluation framework was presented.

- Requirements Definition & Conversion to Database: Requirements for Automated Driving cars are defined in terms of what is necessary at what level and the corresponding data is created.
- Data Processing: Real-world driving environments / conditions are created as data from actual driving data and accident data.
- Scenario Compilation / Database: Functions required for Automated Driving cars and actual driving environments / conditions are integrated and scenarios are created.
- Assessment of Highly Automated Driving Function: Safety is evaluated through simulations and road tests using actual vehicles based on test scenarios. Whether or not the Automated Driving cars are safe is determined after examining the risk tolerances in the safety evaluation results.

The PEGASUS project itself does not output certification systems or vehicle standards; it instead plays the role of providing input for studying such systems and standards. Therefore, the participants in the project appropriately collaborate with organizations that craft standards such as BASt and Kraftfahrt-Bundesamt (KBA). There is information that Germany is studying the introduction of certification for Automated Driving Level 3 on the Autobahn with 2019 as the target year and that it is the PEGASUS project that largely contributes to such study.

It is likely that Germany is studying a scheme that is shared by OEM companies in the standardized format called the "JSON format", as to the minimum data set required for creating a safety evaluation framework. However, there is also information that, since OEM companies are reluctant to share their data, the scheme is limited to presenting data items and format plans at this time, and reaching an agreement will take more time. Based on this data, general scenarios called "open scenarios" will be generated and shared. The database for storing such scenarios is managed by fka during the project period. The interface of the tool chain used for a series of development and evaluation processes is expected to be standardized and its connectivity secured.

4. Demonstration Projects

As for “Truck Platooning” and “Last Mile Automated Driving Systems”, the entire government is part to discussions and has formulated a specific schedule of progress.

It is important to conduct demonstration tests in situations that can be realized under the current Geneva Convention[52], which assumes the presence of a driver, and in fields where needs for Automated Driving have been actualized.

Specifically, demonstration projects will be conducted53 in correlation with the preceding examples including [1] distribution services by way of unmanned following vehicle platoons[54] on expressways, as a means of freight transport, which is seriously burdened by an insufficient number of drivers, [2] mobile services by unmanned Automated Driving as a means of local transportation in areas where business profitability has deteriorated due to depopulation, and [3] implementation of fully automatic parking in parking lots where safety improvements and a reduction in waiting time are required.

(1) Truck Platooning

i) Ideal future vision and demonstration purposes

Truck distribution businesses in Japan have high expectations for vehicle platoons because of the prospects the concept offers towards improving management efficiency, dealing with a shortage of drivers, and enhancing safety. In particular, the shortage of drivers is a serious problem and looked at as the make-or-break issue of the industry given that drivers are getting older. There is especially strong need to reduce labor in transportation at night over long-distance trunk roads (between Tokyo and Osaka) where it is the most difficult to secure drivers, which could be done by introducing vehicle platooning.

Also, there are expectations of energy-saving effects by improvements in fuel consumption[55] and possible general-purpose operations[56] that existing means of mechanical traction cannot provide.

To realize unmanned following vehicle platooning that can respond to such needs and effects,

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52 The Convention on Road Traffic (1949 Geneva Convention) stipulates that [1] a driver must exist in a vehicle and [2] the driver must drive the vehicle in an appropriate and careful way, etc. In March 2016, the Working Party on Road Traffic Safety (WP1) under the United Nations Economic Commission for Europe (UNECE) issued a statement that “experiments involving Automated Driving vehicles can be conducted under the current Convention, if there is a person with the capability of controlling the vehicle in a state that allows such control, regardless of whether such person is in the vehicle or not”.

53 Projects for three applications shown in the “Next Action Plan” have been promoted.

54 Unmanned following vehicle platoons have a driver only in a lead vehicle and persons in the following vehicles, if they are on board, are not treated as drivers and can conduct work other than driving. However, what kinds of work persons on board following vehicles can do will be decided through future discussions.

55 According to the Development of Energy-saving ITS Technologies (METI and NEDO, FY2008 to FY2012, budget totaling 4,450 million yen), if three vehicles drive in an array (platoon) (with no load) in an inter-vehicular distance of 4m, it is estimated that an average of about 15% of the fuel consumption can be reduced because air resistance of the following vehicles is reduced.

56 Compared with existing mechanical tractions, if vehicles drive in an array (platoon), each truck can independently run before and after the formation of the array (platoon).

as part of the “Research, development and demonstration project for societal implementation of advanced Automated Driving systems: Demonstration for societal implementation of truck platooning”[57], the panel started a project in August 2016 in which it has studied problems concerning technological development, demonstration tests and various business environments.

ii) Overseas trends

Unlike Japan, in Europe and the USA, there are needs for platoons with "manned" following vehicles for the purposes of reducing the burden of drivers, improving fuel consumption and promoting smoother road traffic.

In Europe, a large-scale demonstration test[58] was executed with the participation of several OEM companies in April 2016. Also, in the “ENSEMBLE” project[59], which was announced in February 2018 as an effort relating to all Europe, the participants aim to realize cross-border demonstrations of multi-brand vehicle platoons on public roads by the end of 2021 and commercialize them by 2023. Moreover, in the “Future Truck 2025”[60] initiative for reducing the burden of drivers driving for extended periods of time on expressways, Daimler is promoting efforts for practical application of Automated Driving of a single truck.

In the USA, Peloton Technology[61] has been promoting commercial operation of two “manned” following vehicle platoons since 2017 on expressways using CACC [62].

In addition, Singapore is planning a demonstration project[63] of unmanned following vehicle platooning like Japan from 2017 for the purpose of resolving the shortage of drivers and improving the efficiency of port distribution.

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57 As a project commissioned by METI and MLIT, a group of companies headed by Toyota Tsusho Corporation has conducted the demonstration project. In FY2016, it was called “Smart mobility system research, development and demonstration project: Demonstration for societal implementation of truck platooning”.

58 "European Platooning Challenge 2016: Governments and OEM companies cooperated in conducting a demonstration of vehicle platooning from several bases to Amsterdam with the government of Netherlands playing a central role. DAF, Daimler, Iveco, MAN, Scania and Volvo participated as truck manufacturers and implemented a platooning demonstration with “manned” following vehicles using CACC, which is existing technology of such companies.

59 ENSEMBLE: Enabling SafE Multi-Brand pLatooning for Europe.
https://clepa.eu/wp-content/uploads/2017/10/CLEPA-Platooning-Panel-A4-V4-HD.pdf#search=%27ENSEMBLE+platooning%27
https://eutruckplatooning.com/News/967655.aspx

60 The initiative calls for a realization of Level 3 by equipping heavy-duty trucks with the Automated Driving system called “highway pilot”. A demonstration was held in Nevada, USA and Germany in 2015.

61 Peloton Technology was founded by members centering on a start-up company in Silicon Valley for providing a vehicle platooning service, and Stanford University in 2011.

62 CACC (Cooperative Adaptive Cruise Control): A cooperative inter-vehicular distance maintenance support system that smoothly controls the inter-vehicular distance with the vehicle in front using communication technology in addition to ACC (Adaptive Cruise Control) to maintain the inter-vehicular distance that is set in advance, by grasping the distance with the vehicle in front with sensors.

63 Japanese, European and American players tendered bids and a consortium with Scania and Toyota Tsusho Corporation as the representatives was selected. A 10 km route linking ports is assumed as the driving course.

Japan needs to continuously pay attention to these overseas trends when it promote its own initiatives.

iii) Progress and policies for implementation

The panel has studied matters related to safe inter-vehicular distance for public road demonstrations and developed a driving plan that specifies a specific driving location and driving method. From January 23 to 25, 2018, between Shin-Tomei Expressway Hamamatsu SA and Enshu Mori-Machi PA, a demonstration test of vehicle platooning on a public road[64] was conducted using CACC[65] and trucks made by different manufactures, for the first time in the world. In this test, the panel checked the effects of trucks driving in an array on other vehicles in the surrounding area[66]. Also, from January 31 to February 1, 2018, from the Mibu PA to Kasama PA on the Kita Kanto Expressway, a technical demonstration test[67] was conducted to check the response of the vehicle platooning to the difference in road elevation. In the demonstration tests, two interruptions (areas for merging in and out of traffic) occurred while driving (about 15 km x 13 times) on a section of the Shin-Tomei Expressway with 3 lanes and 20 interruptions occurred while driving (about 50 km x 12 times) on a section of the Kita Kanto Expressway with 2 lanes. Therefore, it is necessary to study inter-vehicular distance and driving at the time of merging into and leaving the traffic flow. In a comparison between a section with three lanes on one side and a section with two lanes on one side, when heavy-duty trucks passed the platooning vehicles, many other vehicles passed them as well by following the trucks. The driver of the vehicle platoon in the test commented that it was easier to drive in the section with three lanes on the side and that it was difficult to change lanes in the section where the 3 lanes converged into 2 lanes, due to confusion caused by other vehicles.

Scheduled in FY2018 are a vehicle platooning demonstration using CACC under different loading conditions and a separate demonstration with an LKA[68] function added in addition to CACC. The panel will promote these demonstration tests and establish the necessary technology[69] for fostering social acceptance in the future. Moreover, in preparation for commercialization in the private sector[70], the panel aims to achieve platooning with unmanned following vehicles on the Shin-Tomei Expressway in 2020 and its

64 Three trucks drove in an array (platoon) of about 100m in total length.

65 760MHz ITS communication is used for inter-vehicle communication.

66 The effects include how the trucks driving in an array (platoon) are recognized by occupants of surrounding vehicles and affect the passing of surrounding vehicles.

67 Four trucks drove in an array (platoon).

68 LKA (Lane Keeping Assist): This lane keeping assist system prevents lane departure by grasping lanes with sensors. When the ACC is operating, the LKA supports the driver's steering operation so that the vehicle stays in its lane.

69 In addition to the technologies mentioned in Table 2, high-accuracy own vehicle position technology using positioning satellites (GPS or quasi-zenith satellite) has been studied.

70 Accumulation of operation results, improvement of operation control technology, mass-production of trucks, etc.

commercialization in the future.

Most of the problems of unmanned following vehicle platooning that need to be resolved are technologically difficult, e.g., improvements in the safety and reliability of the electronic linkage[71] and effects on the surrounding traffic environment. It is necessary to steadily take steps to solve these problems. So that platooning with 3 or more unmanned following vehicles can be realized, as a project in Japan, the panel will continue studying a step-by-step roadmap that includes "manned" following vehicle platooning, which is the focus in Europe and the USA, in cooperation with the concerned parties[72].

Also, businesses have pointed out a possible need to construct a center (facilities) for forming vehicles platoons, transferring loads, resting and evacuating in places near expressways. Therefore, the panel needs to separately study the road infrastructure in respect of the technology used for vehicle platooning, and operation rules. Also, institutional development concerning vehicle platooning is required from the perspective of ensuring safety. Therefore, the panel will be actively engaged in discussions under the government-led "Outline of Institutional Development of Automated Driving" and continue the study in cooperation with the concerned parties.

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[71] In the project under the "Development of Energy-saving ITS Technologies", elemental technologies such as lane keeping technology required for vehicle platooning were developed and successfully tested on test courses with "manned" following vehicle platooning. Meanwhile, various problems need to be resolved before driving demonstrations on public roads. For example, if electronic links are used (the following vehicles follow the lead vehicle by using sensors and communication, although the vehicles are not mechanically linked), amongst the top-priority issues are the establishment of link safety and the institutionalization of the electronic traction by assuming the link to be safe and secure. Also, the technology developed under the project does not allow trailing vehicles to follow the lead vehicle when white lanes are not used, so sensor performance must be improved. Moreover, it is necessary to take measures against variations in brake performance between vehicles arising from the difference in learning performance.

[72] Specifications in past projects were as follows .
Vehicle speed: 80 km/h
Inter-vehicular distance: 4 to10 m (Interruption by surrounding vehicles is difficult. Fuel consumption is improved by about 10%.)
* Motorcycles were used in the study of trucks.

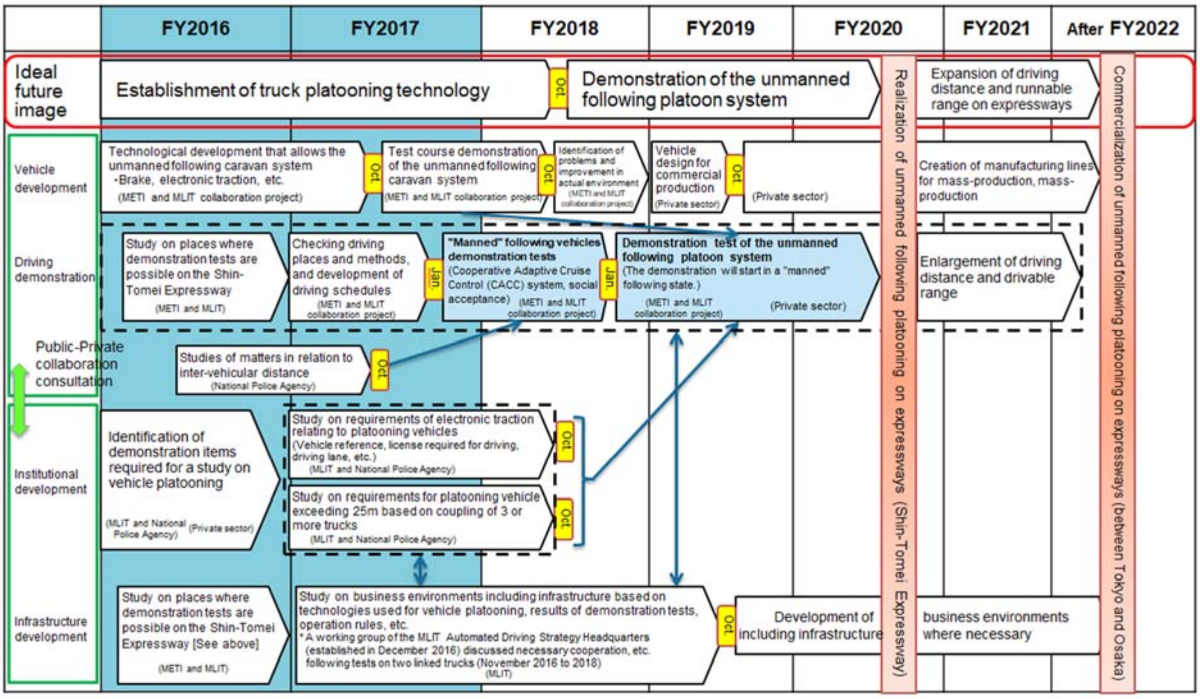
Table 2: Technological tasks for trucks platooning

Basic control	Entire vehicle platooning system (Including vehicles and control center)	○ Materialization of system specifications, system development, international standardization (Including studies of corresponding systems) ○ Demonstration tests on test courses (Verification of safety and reliability) ○ Improvement of control technology ○ Study of merging flow with general traffic (Establishment of control technology and following vehicle monitoring technology and method during electronic linkage, study of institutional handling (Applications of safety standards and the Road Traffic Act)) ○ Establishment of interruption prevention methods ○ Study of HMI basics requirements for lead vehicles
	Functional safety	○ ECU (Actuator), EBS brake (Duplexing, development of safety brake), fail-safe operation of inter-vehicle communication (Radio communication duplexing, duplexing by using optical communication and radio communication) ○ Establishment of detection and response methods when electronic linkage is cut off
	Security	○ Arrangement of security requirements and establishment of measures (In particular, measures against spoofing and DoS attack)
Longitudinal control (Inter-vehicular distance control)	Communication	○ Study of data transmission cycles in inter-vehicle communication, development of communication devices
	Brake control	○ Research and development aimed at reducing variation of EBS brake learning performance (Improvement in inter-vehicular distance performance)
Transverse control	Lead vehicle tracking control	○ Algorithm development for steering control using 3D LIDAR and image recognition

Table 3: Business tasks for truck platooning

Operation form	○ Selection of types of vehicles (Motorcycles, semi-trailers, etc.) ○ Selection of applicable sites ○ Selection of platooning formation method (Matching when starting driving or during driving) ○ Establishment of driving method (Inter-vehicular distance, inter-platooning distance, etc.) by case of use (Merging with and leaving traffic flow, lane changing, parking at PA/SA, and entering and leaving PA/SA, etc.)
Platooning operation management service	○ Establishment of a business model of platooning operation management service (Establishment of parties in charge of business, establishment of business potential, strengthening of international competitiveness, etc.) ○ Arrangement of driving skills required of drivers, establishment of education methods
Social acceptance	○ Demonstration tests (Including the verification of availability) ○ Research on other traffic participants using test courses, driving simulators, etc. (Effects on driver performance and psychology) ○ Establishment of a legal framework concerning vehicles platooning (Road Traffic Act, Road Transport Vehicle Act, Road Act, etc.

Fig.1: Roadmap of truck platooning



(2) Last Mile Automated Driving System (Mobile Service by Unmanned Automated Driving)

i) Ideal future vision and demonstration purposes

There is strong need for a new mobile service called a "Last Mile Automated Driving system" among local governments and local traffic businesses in depopulated areas, to reduce operation costs [73] and resolve the issue of a lack of drivers. Also, from the perspective of reducing the burden of walking and creating a topic for gathering customers, interest in the system is also high in tourist spots and theme parks.

To realize a mobile service corresponding to these needs, the panel started a "Research, development and demonstration project for societal implementation of advanced Automated Driving systems: Demonstration for societal implementation of terminal traffic systems using Automated Driving, etc. in exclusive space"[74] in September 2016.

Ultimately, if Levels 4 and 5 can be realized in mixed traffic with pedestrians and general vehicles, it is expected that the service offering range can be maximized. Meanwhile, since it is technologically difficult to ensure safety only with the vehicle system, building social acceptance is also a big task. Therefore, with the aim of producing a practical application corresponding to actual needs as quickly as possible, the panel will study Automated Driving

[73] In depopulated areas where population is aging, securing means of transportation for elderly people, etc. is an important task. Even if the business is not profitable, as long as the losses are lower than other means, there is a room for studying the last mile Automated Driving system as a new means of transportation.

[74] A group of companies headed by the National Institute of Advanced Industrial Science and Technology has conducted the demonstration as a project commissioned by METI and MLIT. In FY2016, it was called the "Smart mobility system research, development and demonstration project: Demonstration for societal implementation of terminal traffic system using Automated Driving, etc. in exclusive space".

in exclusive space and low-speed Automated Driving on general roads where technical difficulty is relatively low. Attention will also be given to minimizing initial investment and operating costs.

ii) Overseas trends

In Europe, like Japan, there are needs for mobile services of low operating costs and, in urban areas, people are looking to enhanced public transport as a means relaxing traffic congestion, dealing with an aging society and reducing environmental loads. According to ERTRAC[75], Level 4 test-operation in limited areas[76] will be conducted by 2020 in Europe for the purpose of technological demonstration. The plan[77] is to start commercial operation in 2023. Moreover, a verification of Automated Driving at normal speeds on general roads, which presents a higher degree of technical difficulty, is scheduled after 2025. In Sion, Switzerland, since June 2016, Postbus (state-owned bus company) has been conducting a long-term public road demonstration project as technological demonstration (with an operator on board). In Germany, Deutsche Bahn has been conducting a demonstration for its employees in Frankfurt since September 2017. Transportation businesses are also taking initiatives in Germany. As a project model, the premise is to collect a fare from users, receive financial support from local governments and collect funds from indirect beneficiaries in the service area. In the search for the best way to divide up responsibilities, Europe is also leading the world by developing operation management systems (BestMile[78]) and vehicles (EasyMile[79]).

In Singapore, with strong involvement from the government, an Automated Driving-related project was promoted in several public transport systems. U.S. venture company nuTonomy, which provided the world's first Automated Driving taxi test service (with engineers on board) in August 2016, has the final target of complete practical use of an autonomous on-demand transport service in 2018. Japan needs to continuously pay attention to these overseas trends when it promotes its own initiatives.

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75 ERTRAC (European Road Transport Research Advisory Council) is a common technology research platform in the EU (with the participation of major companies, governmental agencies, etc.) with the mission of establishing the research foundations for improving transportation systems across the entire EU.

76 The limited areas are places where driving at low speeds has little effect on the surroundings (including public roads with mixed traffic).

77 As a precondition to introducing the last mile Automated Driving system and to ensuring sustainability as a business (with the minimum tax input), the basic concepts are to [1] reduce initial investments and operation costs (with a focus on small-size vehicles and use of existing infrastructure and rigorous demand estimate), [2] introduce the operation in city suburbs and industrial areas, and [3] conduct short-range and small-scale operations.

78 This Swiss start-up company offers fleet management service solutions for Automated Driving vehicles. The company was founded in January 2014 as a spin-off from the Swiss Federal Institute of Technology.

79 This French start-up company develops and markets Automated Driving small-size mobility solutions. It was established in 2014 as a joint venture between Ligier (manufacturer of small-size vehicles) and Robosoft (industrial robot manufacturing/developing company).

iii) Progress and policies for implementation

The last mile Automated Driving system has no existing project model. The system needs to be promoted to mainly resolve social issues and there are many important tasks including institutional aspects. Therefore, the panel will promote necessary actions as cooperative areas.

The mobile services required in different areas are diverse, and how to realize Automated Driving in exclusive spaces and gain social acceptance of new mobile services differs. Therefore, a selection of applicable areas is first and foremost important. In the "Smart mobility system research, development and demonstration project: Demonstration for societal implementation of terminal traffic system using Automated Driving, etc. in exclusive space", four model areas - Hitachi City, Ibaraki (community bus model), Wajima City, Ishikawa (urban area model), Eiheiji Town, Fukui (depopulated area model), and Chatan Town, Okinawa (tourist spot model) - were selected in March 2017 for conducting demonstration tests.

So far, on December 17 and 18, 2017, a demonstration test started in Wajima City, Ishikawa (urban area model) with the cooperation of public-private councils and relevant ministries and agencies. In the demonstration on December 18, Automated Driving with no person in the vehicle was performed for the first time on public roads in Japan. Also, on February 7, 2017, a demonstration test started in Chatan Town, Okinawa (tourist spot model). In the demonstration in Wajima City, in-vehicle maintenance staff operated the brake 4 times during the 15 tests over the 1 km course because of erroneous detection by the sensors and sideward skidding due to snow. Therefore, it is necessary to improve the vehicle systems such as the sensors and algorithms for future demonstrations. In the demonstration in Chatan Town, business operators [80] actually rode in the vehicle and evaluated the remote control type of Automated Driving system including the vehicle allocation system[81], operation and management, etc. Based on the evaluations, it is necessary to improve the system.

The demonstrations in Eiheiji Town, Fukui (depopulated area model) and Hitachi City, Ibaraki (community bus model) will start as soon as preparations are complete.

In FY2018, the safety of Automated Driving with no person in the vehicle will be promoted by stopping the vehicle remotely by way of a radio unit without maintenance staff on board. Also, the Automated Driving function will be strengthened to reduce the burden on the remote operator. After such measures, the efforts from [1] to [3] will be made with demonstration tests. [1] The demonstration test period in some areas will be extended for up to one month. [2] Staff from the local service provider performs remote control. [3] One remote monitoring operator monitors and operates several vehicles. Moreover, preparations will be made for commercialization in the private sector with the aim to realize and commercialize unmanned mobile service in 2020.

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80 These businesses are expected to either be in charge of or support the service in the local area.

81 Services for making reservations and allocating vehicles are assumed.

While continuing studies from both technical and business aspects, the panel will promote analysis and effective use of data obtained in the demonstrations.

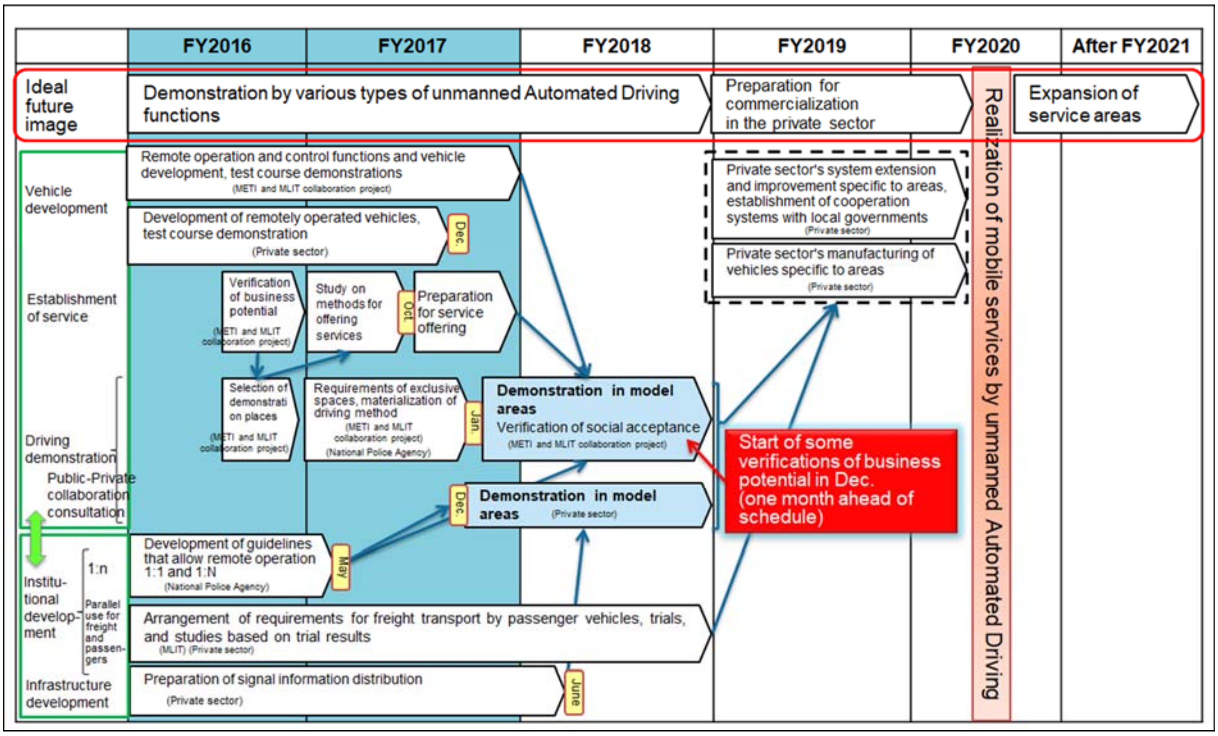
Table 4: Technological tasks for last mile Automated Driving system

Entire system Longitudinal (Inter-vehicular distance) and transverse control	○ Establishment, standardization and international standardization (including institutional structures) of system specifications complete with acceptance criteria, and establishment of system verification method ○ Cost reductions of Automated Driving vehicles and control system, etc., study of vehicle mass-production systems ○ Establishment of vehicle peripheral recognition technology, verification of autonomous control such as obstacle collision avoidance ○ Verification and criteria creation of control technology that enables efficient operation including remote monitoring and control ○ Demonstration tests on test courses and actual public roads (Verification of safety and reliability)
Functional safety	○ Establishment of autonomous control and strategies for dealing with uncontrollable vehicles
Security	○ Arrangement of security requirements (Including communication and vehicle theft) and establishment of measures (In particular, measures against spoofing and DoS attacks)

Table 5: Business tasks for last mile Automated Driving system

Operation form	○ Study of operation methods, etc. according to applicable places ○ Arrangement and standardization of requirements of exclusive space, studies of operation on public roads
Mobile service / operation business	○ Establishment of business models for mobile service / operation business (Establishment of parties in charge of business, establishment of the business potential, etc.) ○ Demonstration tests (Verification of costs and availability) ○ Improvement of operation management technology (Efficient operation and management in consideration of supply-demand balance, optimal charge management)
High-accuracy maps for mobile service	○ Sharing of recognition concerning applications ○ Verification and standardization of location and environment recognition technology ○ Standardization of specifications (contents of necessary read-ahead information (including types of dynamic information), construction, institution, collection and analysis and distribution method, international cooperation, etc. ○ Establishment of business models (Parties in charge of business, business potential, development, update, international competitiveness)
Social acceptance	○ Demonstration tests (Including verification of availability) ○ Clarification of risks and advantages in applicable places, and forming agreements as to the concept of introduction based on such clarification ○ Creation of coexistence spaces with other traffic participants, study of affinity, coordination with stakeholders

Fig.2: Road map of last mile Automated Driving system



(3) Fully Automatic Parking

i) Ideal future vision and demonstration purposes

Japanese parking lot businesses have high expectations in fully automatic parking because of the improved safety, greater customer satisfaction (less waiting time and foot movement), enhanced management efficiency (increased availability and parking efficiency, reduced personnel expenses) and other anticipated benefits. In particular, there are strong needs in parking facilities where the lot or garage is far from the entrance of the destination (flat type such as suburban shopping centers and theme parks and mechanical types in buildings and condominiums in urban areas specific to Japan and Asia).

To realize fully automatic parking corresponding to such needs, the "Research, development and demonstration project for societal implementation of advanced Automated Driving systems: Demonstration for societal implementation of fully automatic parking for general vehicles"[82] started in August 2016.

Ultimately, it is desirable to realize fully automatic parking in all sorts of parking facilities where pedestrians and general vehicles with no Automated Driving function exist. However, the truth of the matter is that it is technically difficult to ensure safety in general parking facilities with just equipment on the vehicle side. Therefore, first, while looking to minimize

82 The project was commissioned by METI and MLIT, and is being conducted by a group of companies headed by Japan Automobile Research Institute. In FY2016, it was called the "Smart mobility system research, development and demonstration project: Demonstration for societal implementation of fully automatic parking system for general vehicles."

the burden placed on both vehicles and parking facilities, the panel will develop parking facilities dedicated to fully automatic parking (exclusive space separated from general traffic such as pedestrians and general vehicles with monitoring devices installed inside the parking lots and control center) and ensure safety via cooperation[83] between vehicles and control center in the parking lots.

ii) Overseas trends

There are also overseas movements aimed at practical applications in fully automatic parking. For example, car2go[84], which Daimler promotes, announced a tie-up with Bosch in June 2015 for realizing a service that combines car-sharing and fully automatic parking. The parking management system (parking lots infrastructure and control center)[85], which Bosch develops, is in the demonstration phase. In July 2017, a demonstration video of fully automatic parking at the Mercedes-Benz Museum jointly managed by Daimler and Bosch was released[86] and preparations are underway for the general public to try in 2018. With this project, they are establishing a de facto standard for future systems and included security measures. Also, in the FP7 project V-Charge[87] in the EU, the possibilities of fully automatic parking were shown in a demonstration that combined a recharging system for electric vehicles and fully automatic parking. It was conducted in July 2015 with the participation of VW and Bosch. Moreover, in the Horizon2020 project UP-Drive[88] in Europe, VW is taking the initiative to promote technological development required for incorporating the fully automatic parking system developed in the FP7 project in inner-cities. Japan needs to continuously pay attention to these overseas trends and deal with the issue with a sense of speed when it promotes its own initiatives.

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83 As examples of cooperation between vehicles and control center in parking lots, the following division of roles is possible. After the vehicle enters the parking lot, [1] the driver gets out, [2] the control center distributes the map of parking lot to the vehicle and instructs a driving route, speed and parking position, and [3] the vehicle parks in the instructed spot at a low speed by checking the surrounding safety. Before the vehicle leaves the parking lot, [1] the driver conveys his/her intention to leave or requests the desired leaving time to the control center, [2] the control center instructs a driving route, speed and stop position (driver boarding position / waiting place), and [3] the vehicle parks in the instructed position at a low speed by checking the surrounding safety. The parking facility needs to ensure safety measures such as safe separation of the vehicle from pedestrians and general vehicles.

84 Reference URL:http://www.bosch.co.jp/press/group-1506-02/

85 "Active parking lot management": This service is the stage of development and demonstration. With it, sensors installed in the center of the parking spot regularly check the vacancy state and transmit the information to the control center. Based on the information, the control center reflects the vacancy state of the parking spots in real-time and distributes it to parking facility users and administrator.

86 Reference URL:
Mercedes-Benz presents AVP: Bosch and Daimler realized Automated Valet Parking.
https://www.youtube.com/watch?time_continue=2&v=Y1Y1ChYabWw
https://www.daimler.com/innovation/case/autonomous/driverless-parking.html

87 Reference URL:http://www.v-charge.eu/?cat=5

88 Reference URL:
Up-Drive: Automated Urban Parking and Driving, Horizon2020 Project ID: 688652
https://cordis.europa.eu/project/rcn/199138_en.html
http://up-drive.eu/

iii) Progress and policies for implementation

For the development and dissemination of fully automatic parking, it is necessary to clarify the division of roles between "vehicles", "control centers", and "parking facility infrastructure", and form an agreement among the parties concerned as to the prospects of introduction and technological standardization as those three elements. The panel proposed the international standardization of such specifications, which were officially registered as preliminary work items (PWI), with the support of Germany, USA, UK, and South Korea at the TC204WG14 general meeting held in Oakland in October 2017. This started the discussion. Also, since modeling of the project is a task, the panel has done the verifications by simulation.

In FY2018, the panel will utilize simulations, because of various studies into the effects of fully automatic parking they allow, and demonstrations, to form a consensus among the concerned parties, which includes actual parking facility businesses and vehicle manufacturers, and promote efforts for international standardization (Fig. 10).

Through such efforts, preparations will continue to be made in the private sector. Then, after 2021, the panel will work to launch fully automatic parking services, starting with rental car services in tourist areas and business car lease services. where both fully automatic parking-compatible vehicles[89] and exclusive fully automatic parking lots can be developed. In the future, when the societal implementation of Levels 4 and 5 is achieved, it is expected to advance to fully automatic parking in general parking lots and greatly solve the problems associated with parking lots in Japan.

Table 6: Technological tasks for fully automatic parking

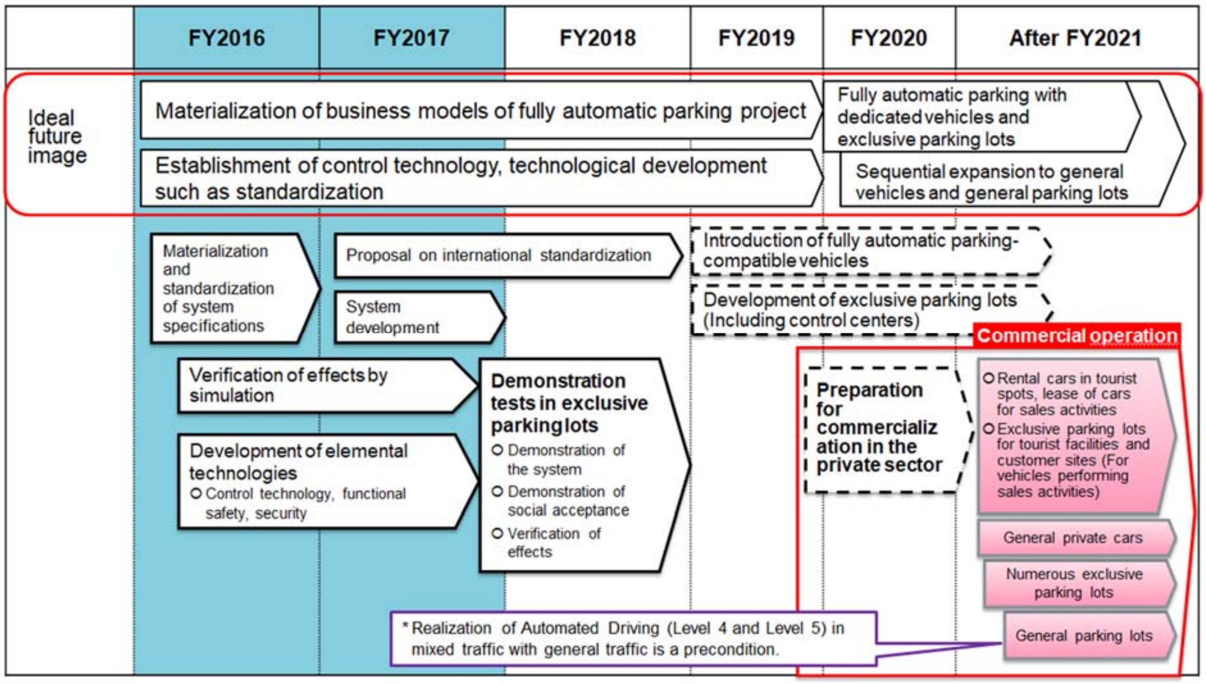
Entire system (Vehicles, control center, parking lots infrastructure)	○ Materialization of system specifications, system development, international standardization (Including infrastructure cooperation control parts on the vehicle side, and studies of institutions) ○ Improvement of control technology ○ Standardization of control methods (Methods of distributing driving routes and parking positions to vehicles) ○ Demonstration tests at test facilities (Verification of safety and reliability)
Functional safety	○ Establishment of strategies for dealing with uncontrollable vehicles
Security	○ Arrangement of security requirements and establishment of measures (In particular, measures against spoofing and DoS attack) ○ Establishment of a method for delegating driving authority

Table 7: Business tasks for fully automatic parking

Operation form	○ Establishment of business models
Infrastructure	○ Development of infrastructure such as parking facilities

89 As preconditions, advanced driving assistance functions must spread to expressways and remote parking functions must be advanced (around 2018 to 2020).

Fig.3: Road map of fully automatic parking



5. Strategic Initiatives concerning Rules (Criteria and Standards)

The formulation of rules (acceptance criteria and standards) requires strategic initiatives, as they are directly connected to business, so that Japan can lead the world and strengthen its competitiveness in the field of Automated Driving. As shown in the panel's “Interim Report”, in order to strategically deal with the formation of rules, METI and MLIT are collaborating on a mechanism for cross-sectional information-sharing and strategic studies of criteria and standards in cooperation with organizations related to criteria and standards.

(1) Institution for studying criteria

International safety criteria for vehicles have been formulated in the intergovernmental meeting (WP29) of the United Nations Economic Commission for Europe (UN-ECE), and Japan has been actively participating in the meeting to contribute to international harmonization activities.

Discussions about Automated Driving have been held in the “Automated Driving Subcommittee” (established in November 2014) to handle general themes including definitions of Automated Driving and security, and the “Automatic Steering Expert Meeting” (established in February 2015) to revise current international criteria that prohibits automatic steering. Japan co-chairs the “Automated Driving Subcommittee” and “Automatic Steering Expert Meeting” together with the UK and Germany, in which role it is tasked with leading international discussions.

To study Japan's policy for conducting such international activities, the government, National Agency for Automobile and Land Transport Technology (National Traffic Safety and Environmental Laboratory), automobile manufacturers, and suppliers have launched an industry-academia-government collaboration system, and have been enhancing the system[90].

(2) Institution for studying standards

As for international standards related to Automated Driving, Japan can lead the discussions, as the chairmen for important meetings[91] were selected from Japan[92]. However, cross-sectional information-sharing and strategic research were not necessarily sufficient because studies in Japan were generally conducted by each corresponding international study group (SC and WG). Therefore, after taking the complicated relationship between ISO/TC204 (ITS) and TC22

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90 Japan Automobile Standards Internationalization Center (JASIC) provides a place for such international criteria creation activities.

91 The international standardization of ITS (Intelligent Transport System) has been promoted under the ISO (International Organization for Standardization), IEC (International Electrotechnical Committee), ITU (International Telecommunication Union), etc. In particular, ISO/TC204 (TC: Technical Committee) is a committee specializing in the standardization of ITS. In the ISO, SC (Sub Committee) and then WG (Working Group) are normally established below TC. In TC204, however, WG is established directly below TC.

92 In TC22, Japan was selected as Chairman and Secretariat of SC32 (Electrical and electronic components and general system aspects) that deals with information security and functional safety. In TC204, the Convener was selected from Japan for WG3 (ITS database technology) for map information and WG14 (Vehicle/Roadway warning and control systems) for vehicle running control.

(vehicle) into consideration, the “Automated Driving Standardization Study Panel”[93] was established under the Society of Automotive Engineers of Japan, which is the Japanese investigation organization in this field, to promote cross-sectional communication.

Based on “strategic standardization areas and prioritized themes”[94] presented by the Japan Automobile Manufacturers Association, the Automated Driving Standardization Study Panel will organize specific standardization items, and study and draft a strategy including setting prioritized standardization items in cooperation with the Japan Automobile Manufacturers Association.

Moreover, the number of NWIPs (New Work Item Proposal)[95] for the entire automotive technologies [95] has been increasing remarkably in recent years, with TC22 increasing from 17 proposals (2005) to 45 (2015) (about 2.6 times in 10 years) and TC204 increasing from 10 proposals (2005) to 27 (2015) (about 2.7 times in 10 years). To deal with such circumstances, it is necessary to continue studying the development of human resources for conducting standardization activities, not just limited to Automated Driving but much broader interests, and strengthen the mechanisms and budget for securing resources.

(3) Cross-sectional Information-Sharing and Strategic Studies of the Criteria and Standards

The development of criteria and standards will play a large role in the progress of Automated Driving. For Japan to dominate international competition in Automated Driving based on rules, it is necessary to have an international strategy in view of criteria and standards.

Therefore, in FY2016, the Automated Driving Criteria Institute [96] was established as a place for strategic study into linking criteria and standards according to the "Next Action Plan".

In the Automated Driving Criteria Institute, discussions at international conferences on criteria and standards that have been continuously held can be shared among parties concerned with both criteria and standards. Also, fields that require collaboration between criteria and standards can be materialized, such as that for organizing scheduled criteria and standard items concerning HMI, safety evaluation and proof, data saving and performance warranty, and surveys on vehicles and security technologies. The concerned parties are expected to deepen discussions so that Japan can lead international activities concerning Automated Driving in the future.

As specific efforts, a symposium was held as part of the institute's initiatives on February 24, 2017. There, the institute took the initiative to report on efforts including to explain international trends amongst European and American government offices and introducing ongoing criteria and standards activities in Japan. In FY2017, the institute organized the contents of cooperation in

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93 It was launched as “Automated Driving standardization liaison association” in March 2015 and renamed to “Automated Driving Standardization Study Panel” in December 2015.

94 Prioritized themes are “running control”, “map”, “HMI”, etc.

95 The work item proposals for establishing new standards and revising current standards.

96 This institute was established in the Japan Automobile Standards Internationalization Center (JASIC) on May 24, 2016 with the National Agency for Automobile and Land Transport Technology (National Traffic Safety and Environmental Laboratory) as the director and has as members JAMA (automobile manufacturers), Japan Auto Parts Industries Association (suppliers), the Society of Automotive Engineers of Japan, Japan Automobile Research Institute, METI and MLIT.

criteria and standards concerning Automated Driving technology. In the future, the institute will promote efforts based on those contents and actively conduct surveys on marketing timing of Automated Driving functions in Japan and overseas in order to further build on Japan’s strategy.

6. Promotion of Industry-Academia Collaboration

High expectations are placed on universities and research institutes in Japan as to their functions such as basic research, human resources such as human resources development relating to software and cyber security, and facilities and environments that cannot be operated by individual companies such as test courses. To serve such expectations, the panel aims to establish a system of study in "cooperative areas". Also, in order to have universities and research institutes play their roles, the panel aims to realize a mechanism that enables the exchange and supply of human resources among industry, universities and research institutes, research funding by government and industry, and improvements to facilities.

As for cyber security, progress is being made on a center for developing cyber security technology via business-academia collaboration.

Also, several Japanese universities have been considering creating a cooperative research institute that can compete with overseas industry-academia-government research organizations and deal with problems specific to Japan, and another research organization with investment coming from industry, academia and government. Specifically, Japanese universities are discussing the [1] the respective roles of industry, academia and government, [2] creating a mechanism that would enable a continuous flow of funds among industry, academia and government, [3] the ideal form of human resources development, and [4] promoting collaboration between different fields.

Moreover, the scale of joint research in industry-academia-government collaboration is extremely small in Japan[97]. Therefore, to realize "full-fledged joint research" with all organizations involved, METI and the Ministry of Education, Culture, Sports, Science and Technology compiled in November 2016 a "Guideline for Strengthening Joint Research in Industry-Academia-Government Collaboration"[98] that intends to help universities and research institutes [1] strengthen their headquarters functions, and establish a [2] virtuous cycle of funding, [3] virtuous cycle of knowledge and [4] virtuous cycle of human resources. It is important to promote study in the future so that, when universities and research institutes modify their management concepts to this guideline, industry-academia-government collaboration in Automated Driving becomes "full-fledged joint research" with all organizations involved.

Based on such efforts, the panel will promote industry-academia discussions as to the roles and fields of universities, and study possible projects in order to realize Automated Driving.

97 As for the average joint research budget per project, joint research expenses with overseas universities generally exceed JPY 10 million. However, joint research expenses with Japanese universities are extremely small with budgets below JPY 1 million accounting for 40% and budgets of JPY 1 million yen to below JPY 3 million yen similarly accounting for 40%. The overall picture shows that research funding to universities and public institutions by companies accounts for only 0.9% of the entire research outlay from companies in Japan. Compared with European countries such as Germany (6.0% of the entire research expenses spent by companies) and the USA, corporate investment in universities is extremely small in Japan.

98 http://www.meti.go.jp/press/2016/11/20161130001/20161130001.html

7. Conclusion

In FY2015, the panel studied an ideal future vision and cooperative areas concerning expressways, and presented concrete policies. In FY2016, the panel studied an ideal future vision and cooperative areas for general roads and presented concrete policies in this report (Version2.0).

In the future, the panel plans to steadily take the initiative, alongside existing efforts, in (4.) Demonstration Projects in (3.) "Cooperative Areas" in order to realize a "Future of Automated Driving" as described in (2.) as early as possible. Also, the creation of (5.) Rules and (6.) Industry-Academia Collaboration are the basis for taking the initiative in cooperative areas. Therefore, the policies in this report (Version2.0) should be taken into account since progress is required on both fronts.

In particular, without cooperative efforts, it is not easy to [1] secure human resources, [2] create maps, make decisions about safety and security requirements, create a certification system, or form an agreement among parties concerned on standardization. Therefore, the panel (secretariat) will individually probe problems and intentions of the concerned parties, promote research in cooperation with them and strategically take initiatives.

As for Demonstration Projects, while obtaining the cooperation of automobile manufacturers in regards to technical problems, the panel (secretariat) and concerned parties should cooperate in taking initiatives on order to achieve the progress set by the Growth Strategy Council - Investing for the Future.

In addition to the above initiatives, the panel (secretariat) will regularly check the progress of these initiatives and flexibly review the initiatives, and study and execute new approaches to changes including overseas trends, technical development and transformation of industrial structures. Thus, Japanese automobile industry including suppliers and relevant industries can cooperate in leading the world and actively contribute to the progress of Automated Driving.

Panel on Business Strategy of Automated Driving
List of panel members, etc.

<Panel members>	(Japanese syllabary order, honorifics omitted, underline: Chairman)
Tateo Arimoto	Professor, National Graduate Institute for Policy Studies (Sub program director, Strategic innovation creation program, Automated Driving system)
Takashi Odaira	Managing Executive Officer, Isuzu Motors Ltd.
Ryuji Omura	Managing Executive Officer, Renesas Electronics Corporation
Koichi Ogawa	Senior Researcher, Policy Alternatives Research Institute, The University of Tokyo
Yoichi Kato	Director, Managing Executive Officer, SUBARU Corporation
Yoshifumi Kato	Senior Managing Director, Denso Corporation
Minoru Kamata	Professor, Graduate School of Frontier Sciences, The University of Tokyo,
Terunao Kawai	Manager, Vehicles Research Department, National Traffic Safety and Environmental Laboratory, National Agency for Automobile and Land Transport Technology
Hidetoshi Kudo	Executive Officer, Mazda Motor Corporation
Ken Koibuchi	Executive General Manager, Advanced R&D and Engineering Company, Toyota Motor Corporation
Takashi Shigematsu	Chairman, Denso Ten Ltd.
Masahisa Shibata	Senior Managing Executive Officer, Panasonic Corporation
Kazuo Shimizu	International automobile journalist
Lei Zhou	Executive Officer, Partner, Deloitte Tohmatsu Consulting LLC
Yoshihiro Suda	Professor, Institute of Industrial Science, The University of Tokyo
Hiroaki Takada	Professor, Institutes of Innovation for Future Society / Graduate School of Informatics, Nagoya University
Masao Nagai	President, Japan Automobile Research Institute
Kunio Nakaguro	Managing Executive Officer, Nissan Motor Co., Ltd.
Shiro Nakano	Senior Fellow, JTEKT Corporation
Yoshiyuki Matsumoto	Director, Senior Managing Executive Officer, Honda Motor Co., Ltd.
Kimiya Yamaashi	Executive Officer CTO and Director of Technology Development Division, Hitachi Automotive Systems, Ltd.

<Observers>

Japan Electronics and Information Technology Industries Association

Japan Automobile Manufacturers Association

Japan Auto Parts Industries Association

The General Insurance Association of Japan

JASPAR

The Society of Automotive Engineers of Japan

National Institute of Advanced Industrial Science and Technology

ITS Japan

Information-Technology Promotion Agency, Japan

Japan Automobile Importers Association

<Secretariat>

METI

MLIT

Roland Berger Ltd.

Development of Studies

Main Meetings of the Panel on Business Strategies in Automated Driving

○ **1st Panel Meeting on February 27, 2015 (Friday)**
- Meeting purposes, etc.
- Current state of Japanese automobile industry relating to Automated Driving
- Current state of business-academia collaboration in Japan relating to Automated Driving

○ **2nd Panel Meeting on April 14, 2015 (Tuesday)**
- Ideal future vision of Automated Driving
- Cooperative areas relating to Automated Driving
- Business-Academia collaboration relating to Automated Driving

○ **3rd Panel Meeting on May 14, 2015 (Thursday)**
- Review and future schedule
- Sharing of the ideal future vision of Automated Driving
- Promotion of business-academia collaboration relating to Automated Driving
- Strategic involvement in rule-making (criteria and standards) relating to Automated Driving
- Concepts for collaboration with the IT industry relating to Automated Driving
- Interim Report outline (plan)

○ **4th Panel Meeting on May 29, 2015 (Friday)**
- Interim Report (plan)

○ **5th Panel Meeting on February 15, 2016 (Monday)**
- Next Action Plan (plan)

○ **6th Panel Meeting on February 17, 2017 (Friday)**
- Action Plan for Realizing the Automated Driving (plan)

○ **7th Panel Meeting on October 4, 2017 (Wednesday)**
1st "Connected Industries Automated Driving Subcommittee"
- Initiatives in data cooperation
- Initiatives in AI system development
- Initiatives in human resources development
- Initiatives in cyber security measures for Automated Driving

○ **8th Panel Meeting on March 15, 2018 (Thursday)**
2nd "Connected Industries Automated Driving Subcommittee" Meeting
- "Connected Industries"' strengthening, acceleration and start items
- Working Group on Safety Evaluation Environment, results and future initiatives
- Action Plan for Realizing Automated Driving Version2.0

Panel on Business Strategies in Automated Driving Sub-WG Meetings

<FY2015>

○ **<u>FY 2015 1st Future Vision Study WG Meeting on September 29, 2015 (Tuesday)</u>**
- Meeting purposes, etc.
- Ideal future vision of Automated Driving and tasks for its realization
- Recent international trends concerning criteria and standards

○ **<u>1st Future Vision Study SWG-A,B Meeting on October 29, 2015 (Thursday)</u>**
- Meeting purposes, etc.
- Ideal future vision and business image of Automated Driving in vehicles platooning and limited space
- Tasks for its realization

○ **<u>FY2015 2nd Future Vision Study WG Meeting on November 10, 2015 (Tuesday)</u>**
- Ideal future vision of Automated Driving
- Cooperative areas for its realization
- Handling of Automated Driving (Level 4)

○ **<u>2nd Future Vision Study SWG-A,B Meeting on December 2, 2015 (Wednesday)</u>**
- Business model of Automated Driving in vehicle platooning and limited space
- Cooperative areas for its realization

○ **<u>FY2015 3rd Future Vision Study WG Meeting on December 15, 2015 (Tuesday)</u>**
- Ideal future vision of Automated Driving
- Cooperative areas and policies for its realization
- State of study in the SWG-A (vehicle platooning)
- State of study in the SWG-B (Level 4 in limited space)
- Automated Driving (Level 4)

○ **<u>3rd Future Vision Study SWG-A,B Meeting on January 20, 2016 (Wednesday)</u>**
- Overseas benchmarks of Automated Driving in vehicle platooning and limited space
- Ideal future vision of Automated Driving in vehicle platooning and limited space
- Cooperative areas and policies for realizing the ideal future vision

<FY2016>

○ **<u>FY2016 1st Future Vision Study WG Meeting on October 5, 2016 (Wednesday)</u>**
- Meeting purposes, etc.
- Clarification of the ideal future vision of Automated Driving

○ **<u>FY2016 2nd Future Vision Study WG Meeting on November 14, 2016 (Monday)</u>**
- Trends in international criteria relating to Automated Driving
- Extraction of cooperative areas themes for realizing the ideal future vision

○ **<u>FY2016 3rd Future Vision Study WG Meeting on December 20, 2016 (Tuesday)</u>**
- Initiatives for business-academia collaboration
- Compiling the schedule of progress of cooperative area themes
- Automated Driving including in mixed traffic (Levels 4 and 5)

<FY2017>

○ **FY2017 1st Informal Follow-up Meeting on April 11, 2017 (Tuesday)**
- Follow-up policy

○ **FY2017 1st Study Working Group on Safety Evaluation Environment Meeting on July 19, 2017 (Wednesday)**
- Sharing of initiatives concerning safety evaluation

○ **FY2017 2nd Informal Follow-up Meeting on July 20, 2017 (Thursday)**
- Study on high-accuracy 3D maps for Automated Driving

○ **FY2017 2nd Study Working Group on Safety Evaluation Environment Meeting on September 7, 2017 (Thursday)**
1st "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG Meeting
- Other industries, overseas trends
- Sharing of database construction project

○ **FY2017 3rd Study Working Group on Safety Evaluation Environment Meeting on December 18, 2017 (Monday)**
2nd "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG Meeting
- Sharing of PEGASUS project interim report meeting
- Cyber security strategy
- Establishment of the Strategy SWG

○ **FY2017 1st Study Working Group on Safety Evaluation Environment, Strategy SWG Meeting on January 19, 2018 (Friday)**
1st "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG, Strategy SWG Meeting
- Initiatives for industry cooperation concerning safety evaluation

○ **FY2017 3rd Informal Follow-up Meeting on February 1, 2018 (Thursday)**
1st "Connected Industries Automated Driving Subcommittee" Tasks Study WG Meeting
- High-accuracy maps of general roads
- Information and communication infrastructure
- Recognition and path planning database
- Software engineering, security human resources
- Social acceptance

○ **FY2017 2nd Study Working Group on Safety Evaluation Environment, Strategy SWG Meeting on February 20, 2018 (Tuesday)**
2nd "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG, Strategy SWG
- Interim Report planning (including the schedule of progress)

○ **FY2017 4th Study Working Group on Safety Evaluation Environment Meeting on February 21, 2018 (Wednesday)**

3rd "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG Meeting

・ Utilization of database construction project
・ Strategy SWG interim report
・ Schedule of progress in safety evaluation
・ Initiatives in FY2018

○ **FY2017 3rd Study Working Group on Safety Evaluation Environment, Strategy SWG Meeting on March 1, 2018 (Thursday)**

3rd "Connected Industries Automated Driving Subcommittee" Safety Evaluation WG, Strategy SWG

・ Sharing of initiatives in the industry
・ Initiatives of FY2018