INTELLIGENT TRANSPORT SYSTEMS

1 Introduction

Intelligent transport systems (ITS) are being developed to help resolve various social issues in the modern transportation environment through the adoption of innovative technologies. Examples of these issues include traffic accidents, congestion, and the increasing load placed on the environment by emissions. In recent years, information and communication technology has been utilized to connect vehicles with other elements of the traffic environment, such as roadside infrastructure, other vehicles, pedestrians, and motorcycles. This concept is referred to as vehicle-infrastructure cooperation. As a result, the scope and possible roles of ITS have expanded further, opening the way to greater possible application. As a result, ITS may have a future as a fundamental technology for building a more prosperous and active society, rather than simply serving as a means to help resolve various issues.

In June 2013, as part of Japan's new IT strategy, the Cabinet Office issued the Declaration to be the World's Most Advanced IT Nation[1], which aims to make IT a cornerstone of Japan's growth strategy and a driving force in achieving sustainable growth and development.

In terms of road traffic, a subcommittee for road traffic was established in October 2013 under a specialized investigation body charged with promoting the new strategy with the aim of realizing the world's safest, most environmentally friendly and most cost efficient road traffic society. In line with the statement on assessing the 10 to 20 year targets set in the Public-Private ITS Initiatives/Roadmap and drawing up that roadmap based on the IT strategy and the schedule for the Declaration to be the World's Most Advanced IT Nation (determined by the IT Strategic Headquarters in June 2013), the subcommittee held discussions in relation to the roadmap centered on driving safety support and automated driving systems, as well as the application of traffic data.

The Public-Private ITS Initiatives/Roadmap was approved at the fifth meeting of the subcommittee for road traffic on March 18, 2014, deliberated at the fourth meeting of the specialized investigation body charged with promoting the new strategy, and finally approved by the IT Strategic Headquarters in on June 3, 2014. The document outlines the general principles and lays out a concrete roadmap for initiatives that require close collaboration between the public and private sectors and aim to build and maintain the world's most advanced ITS, as well as to contribute to society in Japan and the world. The roadmap also defines different levels for automated driving systems, which are currently the object of worldwide research and debate, and for driving safety support systems, and sets expected time frames for commercializing such systems.

In anticipation of rapid changes in ITS-related technologies and industries, the IT Strategic Headquarters is committed to applying a PDCA cycle, generally on an annual basis, to review the Public-Private ITS Initiatives/Roadmap and make any changes necessary. At the same time, the Automated Driving Systems Promotion Committee, made up of members from a broad cross-section of industry, academia and government, was established as the body responsible for promoting research and development of automated driving systems as part of the Cabinet Office's Strategic Innovation Promotion Program (SIP)[4]. This led to assigning the role of promoting ITS-related policies to a joint committee consisting of the Road Committee and the SIP Automated Driving Systems Promotion Committee, which convenes twice a year to evaluate future courses of action and discuss revisions to the roadmap.

In that context, sessions of the subcommittee for road traffic were supplemented by joint meetings of the Road Committee and SIP Automated Driving Systems Promotion Committee held on September 26, 2014 and April 16, 2015 to share information on automated driving research and development and continue discussions on revisions to the Public-Private ITS Initiatives/Roadmap. Touching upon changes in this field since the approval of that document, the discussions covered topics that included the ambitious development plans for automated driving systems announced by various private enterprises, as well as technological advances such as the adoption of the IoT and AI, clarified what automated driving systems Japan should target, and spelled out the need for a strategy concerning the application of traffic data.

After those discussions, the Public-Private ITS Initiatives/Roadmap 2015 revision to the original document includes amendments and additions explicitly laying out strategies to disseminate of various technologies and presenting (a) automated driving systems that contribute to strengthening competitiveness in the global market, (b) regional public transportation systems featuring automated driving functionality and, (c) compact automated driving systems for local communities, as specific examples of systems that should be targeted in terms of development and dissemination for the time being.

Explicit strategies regarding the application of traffic data included (a) more advanced maps and the overlaying of various data, (b) the application of probe data and vehicle-related information and, (c) the utilization of traffic and other big data in various policies and measures, as initiatives to be pursued at present while formulating a basic policy addressing changes in data flow structures.

The Public-Private ITS Initiatives/Roadmap 2015 was approved at the tenth meeting of the subcommittee for road traffic on June 3, 2015, deliberated at the sixth meeting of the specialized investigation body charged with promoting the new strategy, and finally approved by the IT Strategic Headquarters in on June 30, 2015.

Moreover, the June 2013 Comprehensive Strategy on Science, Technology and Innovation and the Japan Revitalization Strategy[(2)] Cabinet decisions established the above-mentioned Strategic Innovation Promotion Program (SIP) to enable the Council for Science, Technology and Innovation[(3)] to fulfill its role as a control center and realize scientific and technological innovation. Benefiting from a budget that extends beyond ministerial and industry boundaries allocated directly by the Council for Science, Technology and Innovation, the SIP program fosters research and development that promotes everything from basic research to forward-looking end results (application and commercialization). SIP is also one of the newly established national emphasis programs in the 2014 comprehensive strategy and is at the forefront of measures aimed at solving the above-mentioned policy issues.

Coordinated government-industry-academia research and development activities on automated driving systems, one of the ten themes initially set when the SIP was established, have been launched with the cooperation of the ministries and agencies involved (the National Police Agency, the Ministry of Internal Affairs and Communication, the Ministry of Economy, Trade and Industry, and the Ministry of Land, Infrastructure Transport and Tourism).

In 2015, the second year of the program, revisions to the research and development plan in May were followed by the ongoing pursuit of activities for international harmonization and coordination, including, an October follow-up to the previous year's international workshop on automated driving. With national goals such as the reduction of traffic accidents in mind, these activities were carried out in parallel with diligent work on more sophisticated dynamic maps and the use of ITS predictive data aimed at realizing and spreading automated driving. In addition, the SIP added cybersecurity as an 11th theme in 2015 and is planning to coordinate research and development related to the security of automated driving systems.

At the second Public-Private Dialogue towards Investment for the Future in November 2015, Prime Minister Abe stated that transport services and automated driving on highways via unmanned autonomous driving systems would be realized for the 2020 Tokyo Olympic and Paralympic Games, and that the required systems and infrastructure, including the implementation of demonstrations, would be developed by 2017. Based on the latest developments in the fields of ITS and automated driving, the joint committee consisting of the Road Committee subcommittee for road traffic and the SIP Automated Driving Systems Promotion Committee then considered refinements to the definitions of automated driving systems and the time frame for their commercialization. It also studied the foundational structure for, and application of, dynamic maps and other traffic data, with a particular focus on the commercialization of automated driving systems for highways and initiatives to realize transport services based on autonomous driving. The resulting revised Public-Private ITS Initiatives/

Roadmap 2016 was released in May 2016. The next step toward implementing large-scale demonstrations on public roads involves even further research and development and integrating outcomes while setting priorities. At the same time, in addition to enhancing technologies and systems through those demonstrations, there are plans for initiatives to identify technological and institutional issues and foster social acceptance.

2 ITS Trends in Japan

2. 1. Vehicle Information and Communication System (VICS)[5]

VICS is an information and communication system that compiles and processes road traffic information (related to congestion, traffic restrictions, and the like) at the VICS Center. This information is then transmitted by radio wave and infrared beacons and FM multiplex broadcasting for display in three forms (text, simple graphics, and maps) on navigation systems and other onboard devices. VICS operates 24 hours a day, 365 days a year. The following three means of transmission are used.

2. 1. 1. FM multiplex broadcasting

Regional NHK and FM broadcasters provide traffic information for roads in and around their respective prefectures. This includes information on congestion or travel times, on traffic restrictions due to accidents, disabled vehicles, roadwork, natural disasters, or weather conditions, and information on parking locations and the availability of spaces there.

2. 1. 2. Radio beacons

These are ITS spot (5.8 GHz band) primarily set along expressways that generally provide information on road traffic within 1,000 km ahead of the vehicle (about 200 km for spot using the 2.4 GHz band). They provide information on travel time between interchanges, congestion, and junctions (including main parallel ordinary roads), as well as on traffic restrictions (e.g., road closures, lane or speed restrictions, requirements on the use of chains) due to accidents, disabled vehicles, roadwork, natural disasters, or weather conditions.

2. 1. 3. Infrared beacons

Set primarily along ordinary roads, these beacons generally provide information on road traffic within 30 km ahead of, and 1 km behind, the vehicle. They provide information on congestion or travel times, on traffic restrictions (e.g., road closures, lane or speed restrictions, requirements on the use of chains) due to accidents, disabled vehicles, roadwork, natural disasters, or weather conditions, and information on parking locations and the availability of spaces there.

In vehicles equipped with receivers, the automatic congestion avoidance function in the navigation system can use the information received from beacons to display the optimum route on the navigation screen, allowing drivers to use the information to drive in accordance with traffic circumstances.

VICS provides various information, including travel times, congestion statuses, and traffic restrictions to navigation systems in real-time for greater driver convenience. Appropriate route guidance from VICS is also effective in reducing CO_2 emissions and environmental load by smoothing traffic streams and improving fuel efficiency. As a result, VICS helped to reduce CO_2 emissions in 2012 by roughly 3.2 million tons.

Furthermore, the new VICS WIDE system launched in April 2015 offers route guidance with high-precision avoidance of congestion based on travel times provided by links on ordinary roads, more detailed traffic information relying on probe data, pop-up advisories for all special weather, tsunami, or volcanic eruption warnings, and information on areas struck by heavy rains.

2. 2. Universal Traffic Management System (UTMS)[6]

The aim of UTMS is to help achieve a safe and comfortable traffic environment with a low environmental load. It achieves this through sophisticated use of information communication technology, including two-way communication between individual vehicles and traffic management systems using infrared beacons. This helps to enhance the safety and smooth flow of road traffic and also alleviates traffic pollution. The main applications of UTMS are as follows.

2. 2. 1. Advanced Mobile Information Systems (AMIS)

AMIS are systems that aim to naturally disperse of traffic streams and alleviate congestion by complementing information from sources such as traffic information signs and radio broadcasts with traffic information sent to onboard devices via infrared beacons. As of the end of 2014, all prefectures in Japan had adopted AMIS.

2. 2. 2. Fast Emergency Vehicle Preemption Systems (FAST)

These systems use infra-red beacons to detect emergency vehicles in areas where call outs are frequent and control traffic signals to give priority to those vehicles.

The aim of FAST is to shorten the time required for emergency vehicles to reach an incident scene or medical facility and to help prevent traffic accidents involving emergency vehicles. As of the end of 2014, 15 prefectures had adopted FAST.

2. 2. 3. Public Transportation Priority Systems (PTPS)

PTPS control traffic signals to give priority to buses and other public transportation. The system aims to reduce journey times and increase user convenience. As of the end of 2014, 40 prefectures had adopted PTPS.

2. 2. 4. Infrastructure-vehicle (I2V) cooperative Driving Safety Support Systems (DSSS)

The National Police Agency (NPA) of Japan is promoting the practical adoption of DSSS.

These systems aim to prevent traffic accidents and otherwise enhance road safety by providing drivers with visual and auditory information on surrounding traffic conditions, alerting them to potential dangers and creating an environment that reduces driving stress.

In 2014, a research study on reducing infrastructure costs for DSSS using radio waves to help prevent failures to notice crossing pedestrians and right-turn collisions. In 2015, the functionality of applicable DSSS was validated on test courses.

2. 3. Electronic toll collection (ETC) system[7]

ETC has gained widespread acceptance since its full-scale introduction of in March 2001. As of the end of December 2015, over 52 million onboard units had been set up, and 24 nationwide expressway and public road management companies use a single nationwide ETC system, which has a utilization rate of roughly 89%. ETC has virtually eliminated congestion at toll booths, which accounted for about 30% of expressway congestion throughout Japan. Consequently, ETC also helps to lower environmental load by reducing CO_2 emissions.

2. 4. Smartway Project

The aim of the Smartway Project is to enhance traffic safety and to develop measures for improving congestion and the environment. In this project, a Smartway is defined as a next-generation road that uses ITS technology to link people, vehicles, and roads by information. Japan is working to achieve Smartways by researching and developing ways of providing next-generation services via I2V coordination through public-private partnerships. As part of the Smartway Project, the adoption of next-generation ITS services (called spot services) has been promoted in recent years. Various ITS spot services started throughout the country in August 2011, mainly along expressways.

2. 4. 1. Nationwide spread of ETC 2.0 services

2. 4. 1. 1. Start of ETC 2.0 (ITS spot) services

The Ministry of Land, Infrastructure Transport and Tourism (MLIT) set roadside devices at roughly 10 to 15 km intervals on inter-city expressways, and at roughly 4 km intervals on inner city expressways, and launched the world's first infrastructure-vehicle cooperative ITS spot service in August 2011 (by the end of the 2015 fiscal year, roadside units had been set at approximately 1,600 locations along expressways throughout Japan).

In addition to ETC and services providing congestion avoidance support and driving safety support information, the roadside devices (ITS spot) are used to collect probe data. The name of the services was changed from ITS spot services to ETC 2.0 in October 2014, and the introduction of services making use of route data, as well as a well-rounded lineup of private services, are being promoted. Full-scale sales of ETC 2.0 onboard units began in August 2015, encouraging the introduction of services that capitalize on route information.

2. 4. 2. Sales of compatible navigation systems and onboard devices

In autumn 2009, seven private companies launched ITS spot-compatible navigation systems and onboard devices. By the end of February 2016, there were 26 companies offering such products, and their popularity is expected to keep growing.

As of the end of March 2016, the number of new ETC 2.0 onboard unit installations had reached a cumulative total of approximately 400,000.

2. 4. 3. Progress of awareness activities related to further popularization

Expositions such as the CEATEC Japan 2015 trade show, held from October to November 2015, featured events and booths to increase awareness of ETC 2.0 services. The booths included panels and videos presenting initiatives that make wise use of those services, as well as, in cooperation with the manufacturers, exhibits of ETC 2.0 onboard units and compatible navigation systems. In addition, proactive initiatives to promote greater implementation of these services at nationwide *michi no eki* roadside stations, as well as expressway parking and service areas were carried out.

2. 4. 4. Initiatives in the fields of transportation and logistics

Although the use of ETC in the fields of transportation and logistics has been limited to the payment of tolls, initiatives to optimize transport by truck via the application of data on routes travelled and usage times collected with ETC 2.0 are being promoted.

2. 4. 4. 1. Streamlining of passage permits for ETC 2.0-equipped special vehicles

Under the current system, special vehicles can only travel on routes for which individual applications have been submitted. Not only does this burden applicants for special vehicle permits with cumbersome application paperwork for each route, it also requires following renewal procedures every two years.

Since the route used by ETC 2.0-equipped vehicles can be identified, a free choice of routes is permitted for vehicles traveling on roads designated as sections allowing the passage of heavy-duty vehicle by the national government. This initiative will enable special vehicles to use an alternative route to avoid congestion or accidents, making more efficient transport possible.

At the same time, the biannual renewal for vehicles following the application procedure for passage will be made automatic. These streamlining initiatives started in January 2016.

2. 4. 4. 2. ETC 2.0 support services for truck operations management

ETC 2.0 allows real-time acquisition of data such as routes traveled, usage times, or acceleration and deceleration. Allowing transportation and logistics operations to make use of that information would enable operations management that leads to greater productivity by reducing delivery wait times through accurate prediction of arrival times, as well as make drivers safer through pinpoint identification of dangerous truck driving locations.

Applications for participation in support services for truck operations management using ETC 2.0 opened in November 2015, and tests started in February 2016. Effects such as the reduction of delivery wait times are under evaluation.

2. 5. Advanced Safety Vehicle (ASV) Project[8]

Since 1991, the Road Bureau of MLIT has promoted the development, commercialization and popularization of ASVs equipped with DSSS that use leading-edge technology through coordination between industry, academia, and the government. In 2015, the further refinement of already commercialized ASV technology and the development of driving safety support systems that use next-generation communication technology, as well as the study of systems addressing abnormal driver states that bring the vehicle to a safe stop when an unusual situation that makes continued driving difficult due to driver health issues or other factors occurs, as well as evaluations related to driver over-confidence, were analyzed as outcomes of the 5th ASV promotion plan, which began in 2011.

In addition, the ASV Project continues to play a supporting role for the commercialized advanced safety technologies it promotes (such as collision damage mitigation brakes, lane departure warning systems, and vehicle stability control systems).

2. 6. Probe data

Probe data consists of information collected by individual vehicles (for example, positional and speed information) using wireless communication technology and used to support traffic management and drivers. In this case, vehicles are used as sensors to collect information about the traffic environment.

In addition to providing information about congestion using conventional VICS data, navigation systems have also been developed by automakers and specialist navigation system manufacturers to use probe data. Services that transmit traffic information about all roads, excluding narrow urban streets, as well as roads compatible with VICS have also been launched.

From the standpoint of the effective utilization of collected probe data, various activities are under way to share and use individual items of data. The mutual utilization of probe data helps to increase the volume of accessible traffic information, thereby enabling the provision of even more refined services. Therefore, it is likely that activities to share probe data through public-private partnerships will be promoted in the future.

In recent years, high expectations have been placed on the use of ITS in traffic smoothing measures.

Over four years starting in 2009, the NPA developed a model project for sophisticated traffic management using probe data. Information from existing roadside sensors was combined with probe data to build a more detailed traffic signal control system based on extensive traffic information in an effort to smooth traffic flow. In 2015, the system was installed in 9 prefectures in conjunction with updates to the central units in the traffic management centers.

Moreover, in the context of establishing an environment for traffic information services that makes use of probe data in the event of a disaster, the NPA will combine traffic data collected from existing information gathering devices with police and private sector probe data to promptly identify usable roads. Such information will not only be passed on to the local population, but also prove useful for police activities on-site (setting extraordinary traffic restrictions or securing emergency routes). In 2015, the system was installed in 9 prefectures in conjunction with updates to the central units in the traffic management centers.

The ITS spot described earlier also allow probe data to be collected from vehicles. When a vehicle equipped with an ITS spot-compatible onboard device passes below an ITS spot, its driving and behavior histories are collected as probe data. The Road Bureau of MLIT will collect and analyze probe data obtained from a large number of vehicles (big data analysis). It plans to carry out initiatives that utilize big data to use the road network intelligently by, for example, identifying the causes of congestion and accidents and applying that information to the formulation of congestion and traffic safety measures.

2. 7. Other (including automated driving systems)

2.7. Other (including automated driving systems)

Japan regards automated driving as a growing field and will be pursuing its implementation as laid out in the Declaration to be the World's Most Advanced IT Nation and the Japan Revitalization Strategy (June 14, 2013 Cabinet decisions) as well as the Comprehensive Strategy on Science, Technology and Innovation (June 7, 2013 Cabinet decision).

With respect to the use of wireless systems, the Ministry of Internal Affairs and Communication (MIC) is responsible for allocating the use of new frequencies and forming policies for technical standards, taking the usage situation of radio waves and interference with other wireless systems into account. In the field of ITS, MIC has already allocated frequencies and formulated technical standards for VICS, ETC, and ITS spot systems to allow new systems to be introduced and existing ones to be made more sophisticated. It has also worked to promote the popularization of these systems[11].

In addition to allocating part of the 700 MHz band freed up by the switchover to digital terrestrial television for the introduction of DSSS to help achieve a safe road traffic environment, MIC has conducted studies on interference with other systems. In December 2011, it set up frameworks by issuing revised ordinances. Since April 2013, these systems have been available nationwide, including in the Tohoku region where the switch to digital television had been delayed by the impact of the Great East Japan Earthquake.

With an eye toward early commercialization, field tests to secure communication reliability, interconnection, and security functions and ensure actual applications provide function properly began in 2014, and vehicles compatible with those systems went on sale in October 2015.

In 2013, comprehensive testing was conducted on 79 GHz band radar systems, which have sufficiently high resolution to detect smaller bodies such as pedestrians. The validation of their performance at distance resolutions of 20 cm or less and angle resolutions of 5 degrees or less has been completed.

In Japan, sophisticated road traffic systems based on vehicle-to-vehicle and road-to-vehicle communications using the 700 MHz band are available for driving safety support systems, and road-to-vehicle dedicated short range communications (DSRC) systems using the 5.8GHz band are available for ETC, ITS and other spot service communications. However, various ITS spot services related to environmental measures or to greater comfort and convenience, which driving safety support systems using the 700 MHz band are ill-suited to cover, are expected to be introduced in the future.

Under those circumstances, and in light of both ongoing studies on the use of the 5.9 GHz band for vehicle-to-vehicle and road-to-vehicle communications in the U.S. and Europe, as well as the need to ensure the future expandability of services while keeping international harmonization in mind, a study of the possibility of introducing new communication systems that do not affect existing dedicated short range communications (DSRC) systems and can be used in conjunction with them began in 2013.

Furthermore, as part of its international standardization initiatives, Japan participated in the November 2013 ITU-R regular meeting discussions of a new recommendation concerning the characteristics of radar systems required to study the shared use of the 79 GHz band, and the resulting new recommendation reflected Japan's growing influence. Japan participated in the November

2014 ITU-R regular meeting discussions of a new recommendation concerning the characteristics of systems to evaluate the shared use of the 79 GHz band by radars and existing radio services such as amateur radio and radio astronomy, as well as the study of interference. The primary allocation of the 77.5 to 78 GHz band to radiolocation services, which is required for 79 GHz high-resolution radars, was approved at the WRC-15 conference in November 2015

Participation in the ITS World Congress in Bordeaux in September 2015 and hosting the ICT for the Next Generation ITS lecture meeting in February 2016, enabled MIC to present the results of ITS-related research initiatives and carry out activities to further promote ITS. In addition, Global or regional harmonized frequency bands for evolving Intelligent Transport Systems was approved as an agenda item for WRC-19. The investigation of standardization trends in various countries and communicating, the building consensus with other parties involved, and other activities related to the international standardization of ITS-related communication protocols and frequencies by ITU-R and other bodies working on international standards in the field of wireless communication were conducted from the standpoint of increasing Japan's international competitiveness.

To establish a technological foundation leading to the realization of automated driving systems that are capable of routine automated and contribute to drastically reducing the number of fatal traffic accidents and to mitigating congestion (next-generation advanced driving support systems), the Ministry of Economy, Trade and Industry (METI) launched new projects in 2014, with initiatives directed at the verification of the effectiveness of driver models, the development and field testing of next-generation surrounding environment recognition technologies, and the development of fail-operational technologies. Of those, initiatives related to the verification of the effectiveness of driver models are presented below.

2.7.1. Verification of the effectiveness of driver models

Although driver models that predict hidden threats are a promising means of anticipating the risks of accidents and responding to them, the effectiveness and practicality of such models remains unclear. This means that in-depth development, including the collection of sample data necessary to build the models, has yet to get underway. This project therefore sets out establish a framework that allows extensive sample data to be collected and analyzed with high accuracy and efficiency, and to build a database using data collected on the behavior of typical drivers (hidden risks database). At the same time, efforts will be directed to developing driver models that address some near-miss cases and install them in driving support systems to verify the effectiveness and practicality of the hidden risks information database and the driver models. In 2015, efforts focused on the development of the data collection devices used to collect extensive sample data, as well as on the study of technology to automatically classify near-miss patterns. Work on developing driver models capable of reacting to the sudden appearance of pedestrians was also pursued.

ISO/TC 204 (Intelligent transport systems) has been working on international standards for the fundamental basic technologies in automated driving systems. Japan has played a leading role in the related field of vehicle control technologies, such as by, for example, obtaining the position of convener for WG 14 (Vehicle/Roadway Warning and Control Systems), which is in charge of international standardization activities in that field. However, with standardization efforts aimed at the early adoption of automated driving systems gaining momentum in the U.S. and Europe, jockeying to take the lead in international standardization efforts is expected to intensify.

Consequently, based on the progress of regional standards in the U.S. and Europe, and while keeping global interoperability in mind, this project has supported the preparation of a draft of international standards for performance requirements as well as international standardization activities (in response to ISO/TC 204 (ITS)) concerning automated driving systems and related systems such as cooperative active cruise control (CACC) and pedestrian collision mitigation systems[10].

An assistance program was established in 2011 by the Policy Bureau and Road Bureau of MLIT to provide support in ensuring, maintaining and improving regional public transportation. Targeted at regions facing an imminent day-to-day transportation crisis, this program aims to offer means of transportation optimized for regional characteristics and circumstances, as well as to introduce barrier-free designs and systems with fewer restrictions to remove impediments to transportation. As part of the policy on these projects, bus IC card systems, bus location systems, and other projects designed to enhance the usage environment of regional public transportation continued to receive assistance in 2015.

3 ITS Trends outside Japan

3. 1. Asia/Pacific[11]

Organizations involved in ITS in the Asia-Pacific region have formed ITS Asia-Pacific (ITS AP), whose current members are China, India, Thailand, Malaysia, Singapore, Indonesia, Australia, New Zealand, Hong Kong, Taiwan, Korea, and Japan.

The most important of the ITS AP activities, the ITS Asia-Pacific Forum, hosted by the Jiangsu Provincial Department of Transport and the Chinese Academy of Highway Sciences under Ministry of Transport, was held form Monday, April 27 to Wednesday, April 29, 2015.

Attended by a record-breaking total of over 10,000 visitors and featuring its first demonstrations as well as an unprecedented large-scale exposition, this turned out to be a grand event that went beyond the concepts seen in past Asia-Pacific forums.

3. 2. U.S.[12]

Government-led projects based on the ITS Strategic Plan 2015–2019 issued by the U.S. Department of Transportation (USDOT) in November 2014, such as the Automation Program, the Connected Vehicle Pilot Deployment Program, and the Smart City Challenge, are being carried out.

At the State level, there are ongoing endeavors such the California pilot projects and the Michigan Smart Corridor project directed by the Michigan Department of Transportation (MDOT). In addition, the University of Michigan's Mobility Transformation Center (MTC) facilities, where various road and urban environments necessary for the evaluation of autonomous vehicles can be simulated, have been completed.

3. 3. Europe[12][13]

Europe is currently transitioning from the European Commission's Seventh Framework Programme (FP7) projects on automated driving to their Horizon 2020 successors. Moreover, various European countries are actively pursuing initiatives related to automated driving. The main European Commission initiatives include the automated driving-related projects under Horizon 2020, the GEAR 2030 High Level Group for the automotive industry, and the roadmaps announced by the European Road Transport Research Advisory Council (ERTRAC).

Individual countries are also actively launching strategies or projects such as the Strategy for Automated and Connected Driving in Germany, Drive Me in Sweden, the Dutch Automated Vehicle Initiative in the Netherlands, government-supported projects in France, and Driverless Cars in the U.K.

3. 4. International activities

The government ministries and agencies involved in ITS, namely the Cabinet Secretariat, Cabinet Office, NPA, MIC, METI, and MLIT Road Transport Bureau held sessions and presented exhibitions at the 2015 ITS World Congress in Bordeaux and other ITS-related events in Western nations, and also engaged in meaningful exchanges with specialists from all over the world.

Among other activities aimed at international coopera-

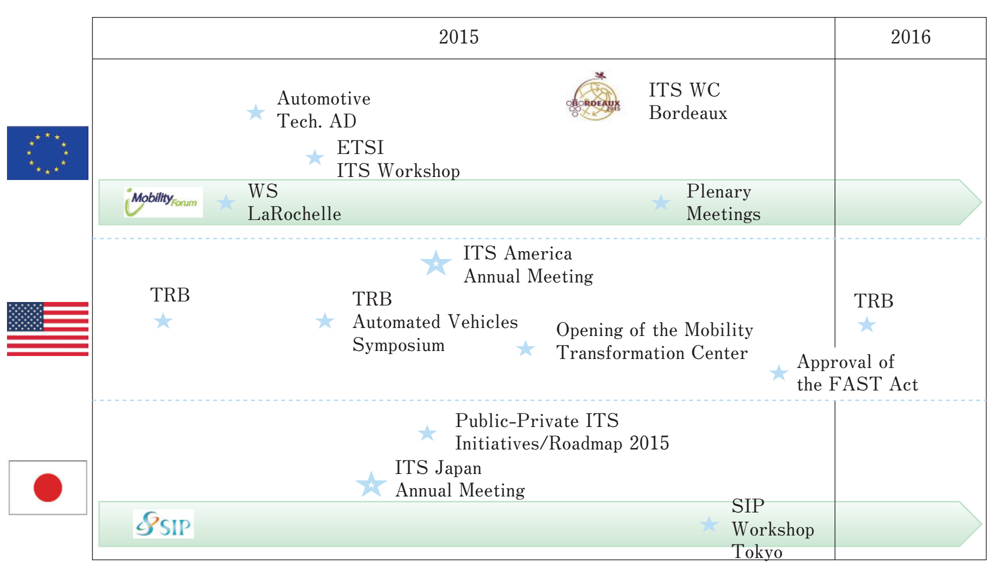

Fig. 1 World events related to ITS (mainly focused on international conferences).

tion and coordination, the second international workshop on automated driving, held in October 2015 under the auspices of the Cabinet Office SIP, provided a venue for discussion for government officials from Japan and abroad. The various ministries and agencies are actively engaged in standardizing their respective technologies and systems. Although there were various proposals and ongoing discussions in 2015, there is unfortunately not enough space in this article to list all the individual initiatives being carried out by government organizations.

International harmonization relationships are being built through international partnership conferences and memorandums of understanding, not only with the U.S. and Europe, but also with Asian countries. Such initiatives will contribute significantly to Japan's future global harmonization efforts.

Led by the relevant ministries and agencies, the government, industry, and academia are carrying out initiatives such as those described above and actively promoting various Japanese initiatives and engaging in exchanges by participating in events outside Japan and inviting specialists from other countries to Japan, who will continue its efforts to lead the world through its technological development even as it pursues global cooperation and coordination.

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