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.

That goal involves striving to realize the world's safest, most environmentally friendly, and most economical road traffic society. Specifically, in conjunction with drawing up a cross-ministerial roadmap, an implementation framework will be built and the development and commercialization of advanced driver assistance technologies and automated driving systems will be promoted.

Based on the above, a subcommittee for road traffic was established in October 2013 under a specialized investigation body charged with promoting the new strategy. To draw up the Public-Private ITS Initiatives & 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 set up working groups to discuss driving safety support and automated driving systems, as well as the application of traffic data in relation to the roadmap.

For driving safety and automated driving systems, in particular, it was recommended that the working groups making proposals to the above subcommittee and the working groups established under a preparatory committee of the Strategic Innovation Promotion Program (SIP) (2) governed by the Cabinet Office's Council for Science, Technology and Innovation jointly work on the study of the roadmaps while maintaining close coordination with other science and technology policies.

The Public-Private ITS Initiatives & Roadmap was released on March 24, 2014. The IT Strategic Headquarters accepted it and set it in motion on June 3, 2014. In the context of the Public-Private ITS Initiatives & Roadmap, it was determined that detailed studies will take place through cross-sectional efforts involving public-private coordination on critical issues, and that the Council for Science, Technology and Innovation (3) would serve as the body providing a framework to foster public-private sector coordination and promote ITS-related policies.

In 2014, the subcommittee for road traffic continued to hold discussions on the remaining issues in, and work on revisions to, the Public-Private ITS Initiatives & Roadmap. The promotion of driving safety support and automated driving systems was reviewed in light of discussions by the Cabinet Office's SIP committee in charge of promoting automated driving systems, while discussions at the subcommittee for road traffic focused on the strategy for the application of traffic data.

At the 8th meeting of the subcommittee for road traffic on February 6, 2015, the secretariat presented a proposal outlining revisions to the Public-Private ITS Initiatives & Roadmap.

As a concrete example, based on current issues in

Japan including the aging of the population and the vitalization of local economies, a clear vision and strategy will be outlined to develop and spread automated driving systems according to the three categories of (1) sophisticated global automated driving systems for existing vehicles (including trucks), (2) local public transportation with automated driving functionality such as buses offering comfortable features equivalent to those of trains in cities, and (3) low-speed compact automated driving systems that the elderly can safely use in depopulated areas or suburbs. Given the major structural changes being brought about by the spread of the Internet of Things (IoT), coordination between traffic data and other fields, and the trend toward open data, the established of a foundation for driving safety support and automated driving-related data, standardization to enable the application of probe data and vehicle-related information, and the use of big data, including traffic data, for public transport were defined as concrete issues. The main points of a proposal aimed at drafting basic strategies for the maintenance and application of traffic data for those issues were discussed.

In 2015, the subcommittee will continue its discussions on revisions to the Public-Private ITS Initiatives & Roadmap. Revisions compiled by the subcommittee will then pass through the specialized investigation body charged with promoting the new strategy for final approval by the IT Strategic Headquarters in June 2015.

In parallel with the above, the June 2013 Comprehensive Strategy on Science, Technology and Innovation and the Japan Revitalization Strategy (4) Cabinet decisions established the Strategic Innovation Promotion Program (SIP) to enable the Council for Science, Technology and Innovation 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. In 2014, after the drafting of the research and development plan in May, activities for international harmonization and coordination, including an international workshop on automated driving in November, got underway. With national goals such as the reduction of traffic accidents in mind, these activities were carried out in parallel with the start of work on more sophisticated dynamic maps and the use of ITS predictive data aimed at realizing and spreading automated driving.

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

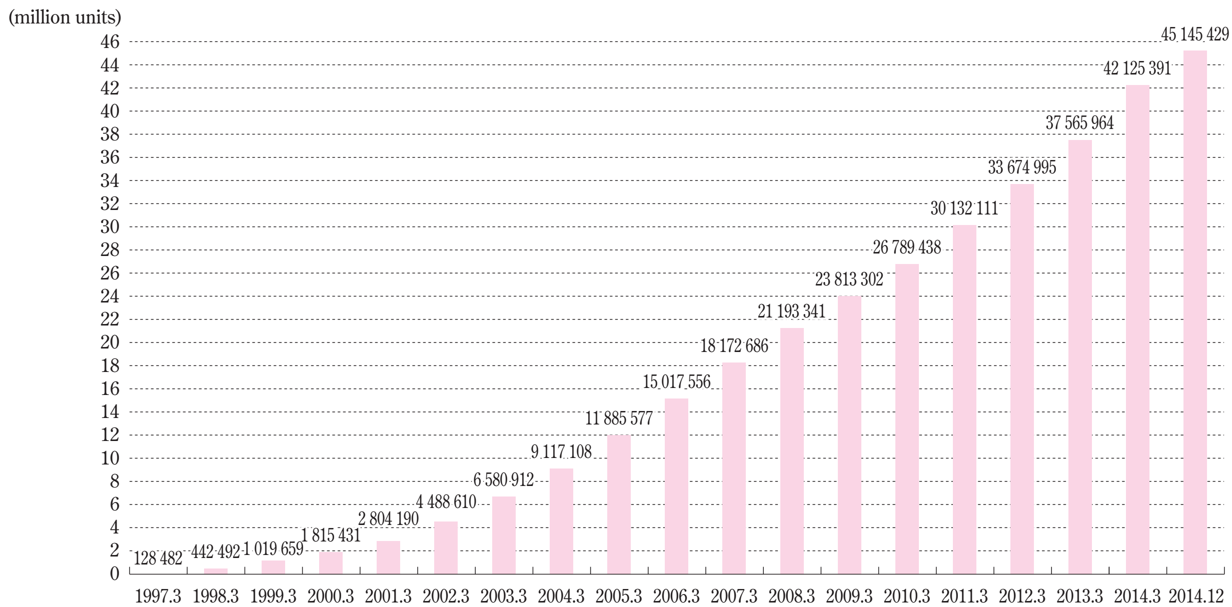
Regional NHK and FM broadcasters provide traffic information for roads in and around their respective prefectures. This includes information on congestion or travel times, on traffic restrictions due to accidents, disabled vehicles, roadwork, natural disasters, or weather conditions, and information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

2. 1. 2. Radio beacons

These are ITS spots (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 spots 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



(Compiled by the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) based on VICS center data)
Source: MLIT

Fig. 1 Number of onboard VICS units.

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.

The number of vehicle navigation systems in Japan exceeded roughly 65 million units at the end of December 2014. Of these, approximately 45 million are compatible with real-time VICS road traffic information (services started in 1996) (Fig. 1). 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 CO2 emissions and environmental load by smoothing traffic streams and improving fuel efficiency. As a result, VICS helped to reduce CO2 emissions in 2012 by roughly 3.2 million tons.

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 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 2013, field operation tests to lower the cost of DSSS equipment were performed on simplified systems that continuously provide information to onboard devices using radio waves and have no connection with traffic management centers. In 2014, a research study on sophisticated DSSS using radio waves was conducted as part of NPA measures related to automated driving systems, which are one of the research themes of the Strategic Innovation Promotion Program (SIP) created under the Council for Science, Technology and Innovation set up by the Cabinet Office.

2.3. Electronic toll collection (ETC) system (7)

ETC is a system that enables non-stop automatic collection of tolls. It uses wireless communication between systems provided in booths at toll roads and onboard vehicle terminals to exchange the necessary information for payment without the vehicle having to stop at the gate.

ETC has gained widespread acceptance since its full-scale introduction of in March 2001. As of the end of December 2014, over 48 million onboard units had been set up, and 24 nationwide expressway and public road management companies use a single nationwide ETC system. Each day, approximately 7.1 million vehicles utilize ETC services, a 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 (8) (9)

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 (ITS spots) 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.

In addition to ETC and services providing congestion avoidance support and driving safety support information, the roadside devices (ITS spots) 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.

2.4.1.2. 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 2015, there were 26 companies offering such products, and their popularity is expected to keep growing.

2.4.1.3. Progress of awareness activities related to further popularization

Expositions such as the October CEATEC Japan 2014 trade show featured events and booths to increase awareness of ETC 2.0 services. The booths included panels and videos introducing ETC 2.0 services, as well as, in cooperation with their manufacturers, exhibits of ETC 2.0-compatible navigation systems and onboard devices. 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.

From January to March 2015, the VICS center subsidized the purchase of ETC 2.0-compatible onboard devices through its campaign to promote the popularization of ETC 2.0-compatible onboard devices, and more such public-private partnership-driven activities are planned.

2.5. Advanced Safety Vehicle (ASV) Project (10)

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. The 5th ASV promotion plan began in 2011. This plan encourages the development of even more sophisticated DSSS capable of autonomous detection and of DSSS that use next-generation communication technology. 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 overconfidence, are also underway.

In addition, the ASV Project continues to play a supporting role for the commercialized ASV 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 (driving history data recorded by onboard devices). Information from existing roadside sensors was combined with probe data to develop technology that generates a full complement of traffic information, including information that can be used for traffic signal controls. It has also utilized the generated information to improve equipment that provides more sophisticated traffic signal control. In 2013, based on four years' worth of results, the prefectures of Ibaraki and Hyogo instituted projects to implement even more precise traffic signal control systems utilizing probe data, and the effectiveness of those systems were measured in 2014.

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 preparation for such uses, the NPA worked on enhancing its wide-area traffic management system in 2014.

The ITS spots 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)

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. More specifically, field testing in locations such as test courses modeling the actual service environment will be used to identify and verify the issues that must be studied for the early commercialization of driving safety support systems that make use of vehicle-to-vehicle communication technologies. Investigative field testing is also being conducted to draw up communication protocols that take communication reliability, interconnection, and security functions into account to ensure actual services function properly.

Since February 2014, the ITS security study group of the Information Security Advisory Board has met to study measures to guarantee the authenticity, completeness and confidentiality of information transmitted through these systems, and submitted requirements for the security of driving safety support systems in the 700 MHz band in June 2014.

In the context of the issues covered by the Council for Science, Technology and Innovation's Strategic Innovation Promotion Program (SIP) research project and in cooperation with the ministries involved in ITS, 2014 has seen further technological development and public road demonstrations in the fields of vehicle-to-vehicle, road-to-vehicle and vehicle-to-pedestrian communications that exchange information such as the relative positions and speed of vehicles and pedestrians, as well as of radar systems using radio waves capable of detecting the presence of vehicles or pedestrians at and near intersections regardless of the weather or other environmental factors.

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 5.8 GHz 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. The ITU-R WP5A, APG, and AWG are currently preparing a report seeking WRC-15 approval for a primary allocation to the radiolocation service in the 77.5 to 78 GHz band.

Participation in the ITS World Congress in Detroit in September 2014 and the ICT for the Next Generation ITS lecture meeting held in March 2015, enabled MIC to present the results of ITS-related research initiatives and carry out activities to further promote ITS policies. From the standpoint of increasing Japan's international competitiveness, investigating standardization trends in various countries and communicating, 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.

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, which means that in-depth development, including the collection of sample data necessary to build the models, has yet to get underway. Therefore, this project 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 from extensive sample data collection experiments predominantly focusing on typical drivers (hidden risks information 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. To draw up specifications for the data collection devices used to collect extensive sample data, the development of test vehicles and data collection from urban road driving started in 2014.

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, METI 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 (12).

Other projects include an assistance program established in 2011 by the Policy 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, assistance for bus IC card systems, bus location systems, the introduction of demand systems, upgrades to other IT systems, and other projects designed to enhance the usage environment of regional public transportation continued to receive assistance in 2014.

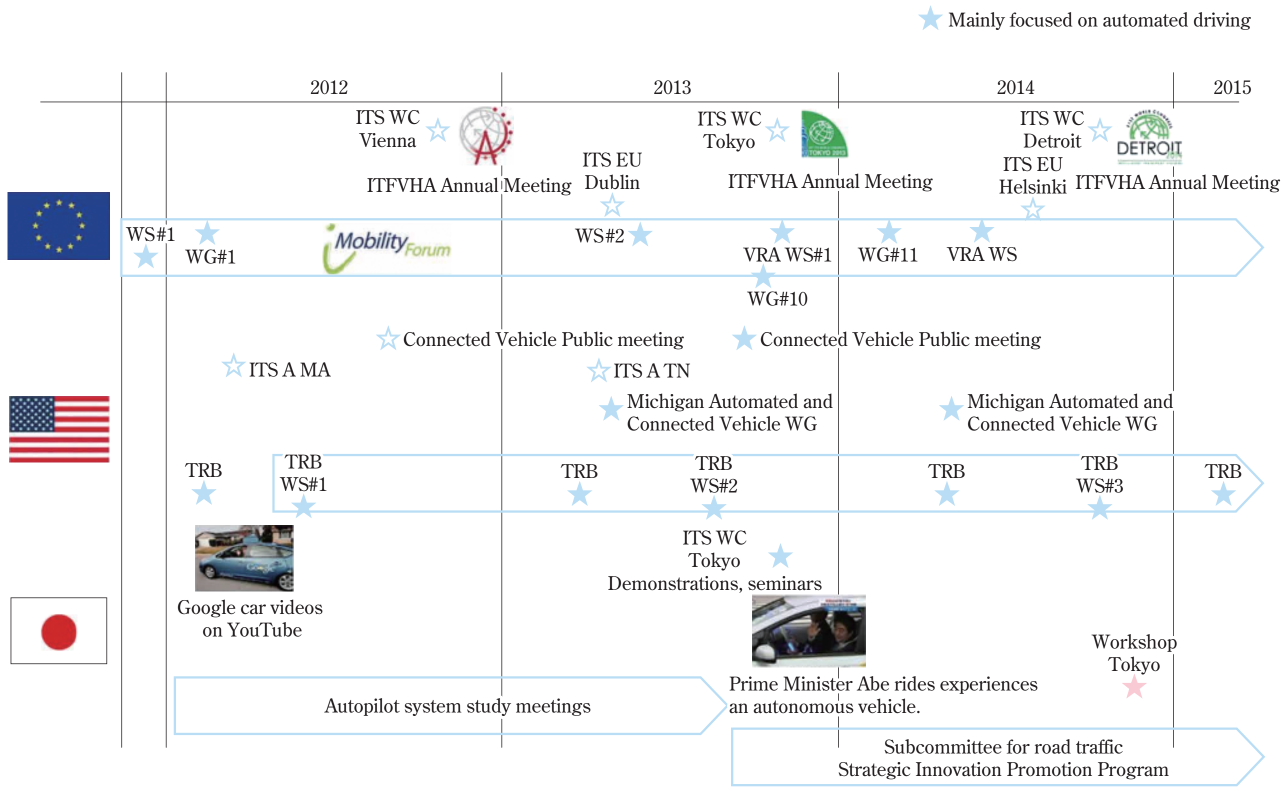
3 ITS Trends outside Japan

3.1. Asia/Pacific (13)

The 13th ITS Asia Pacific Forum and Exhibition 2014 was hosted by New Zealand in Auckland, the country's largest city over three days, from Monday, April 28 to Wednesday, April 30 under the theme of SCORE: safety, choices, opportunities, results, efficiencies. It was attended by 365 delegates (35 from Japan) from 46 countries and featured a total of 46 exhibiting companies and organizations.

3.2. U.S. (13)

In September 2014, the 21st ITS World Congress was held in Detroit (12) (13) under the theme "Reinventing Transportation in our Connected World." It attracted 9,140 participants, including 2,462 registrants, from 65 countries and regions, and 330 exhibiting corporations and organizations. At the Detroit ITS World Congress, attention was strongly focused on automated driving



Source: ITS Japan 2015 annual report

Fig. 2 World events related to ITS (mainly focused on automated driving).

and big data. While national and regional major players and organizations such as the U.S. federal government and Michigan State University were directing their energies toward cooperative driving support and automated driving-centered ITS, it was the significant involvement of local businesses that allowed the Detroit Congress to set an attendance record for the Americas. Participants reached a shared awareness of the need for early-stage international coordination concerning cooperative driving support and automated driving technologies, including the building of new concepts and systems, the standardization of rapidly evolving new technologies, and the fostering of social receptivity based on correct understanding by users.

ITS initiatives not only cover multi-modal transportation (including public transportation) and solutions to road traffic accidents and congestion, but are even expanding to offering mobility that contributes to solving general social issues such as the aging of the population, global warming, and energy supply. Expectations and practical examples involving the application of big data to resolve such issues were introduced.

Even as the severe economic conditions faced by the governments of various developed countries contrast with the expectations placed on the resolution of traffic issues through ITS, new businesses offering resident services drawing on public participation or based on data transmitted by individuals are emerging in conjunction with the growing expansion of the network society. Advances in application development technologies have also made it easy to create applications for information terminals such as smartphones, which has led to greater exploration of means of resolution adapted to regional conditions, as well as increased the presence of venture businesses acting as regional leaders in such efforts.

The event featured 263 sessions, including the CTO summit (a gathering of the chief technology officers at leading corporations in ITS-related fields) and the Middle East Africa Initiatives sessions, which were held for the first time.

3. 3. Europe (14)

The Europe 2020 strategy was announced in 2010. As part of the Horizon 2020 program established to implement that strategy for 2014 to 2020, the transport field has set "Smart, Green and Integrated Transport" as a key objective. The program's 2014 plan is moving ahead with funds allocated to cooperative systems, automated driving, electric vehicles and smart grid technology.

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 2014 ITS World Congress in Detroit and other ITS-related events in the United States, and also engaged in meaningful exchanges with specialists from all over the world.

The various ministries and agencies are also actively engaged in standardizing their respective technologies and systems. Although there were various proposals and ongoing discussions in 2014, 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, industry, academia and government 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. In parallel with global cooperation and coordination, Japan will continue its efforts become a world leader through technological development. Doing so will draw even greater media attention than in the past, and work will proceed hand in hand with related parties to further accelerate commercialization efforts.

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