Automated Vehicle Symposium 2015
Public Agency Automated Vehicle Initiative

SIP-adus: a National Project in Japan

Cross-Ministerial Strategic Innovation Promotion Program
Innovation of Automated Driving for Universal Services

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Last year, Japanese government initiated a research and development project on automated driving systems.

I'm going to talk about back ground, scope, focuses and expected outcome of the project.

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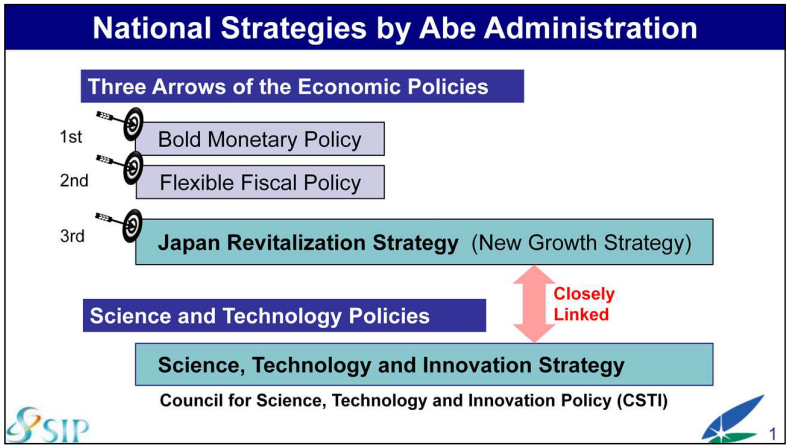
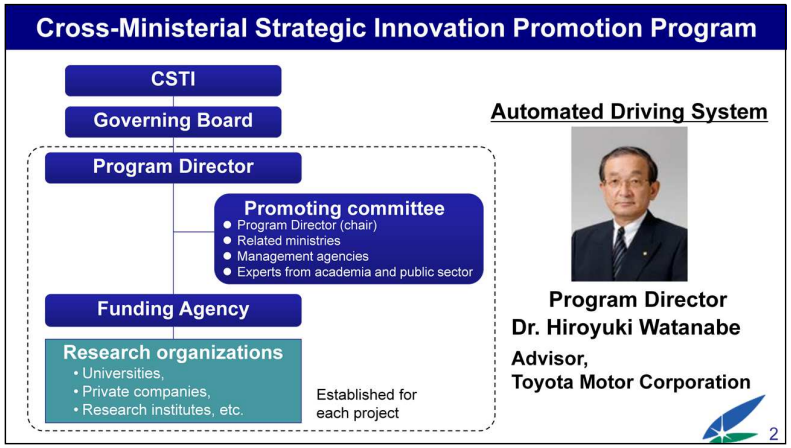
【非公開資料】

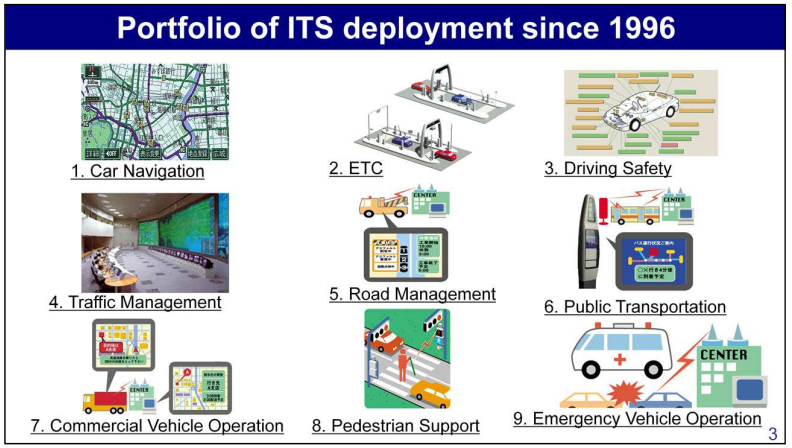


Immediately after inauguration, Prime Minister Abe's administration set out strategies to revitalize Japanese economy and science, technology and innovation. These are closely linked each other.



Under those strategies, a new R&D program was created named 'Cross-Ministerial Innovation Promotion Program' or SIP in short. Ten projects started last year under SIP.

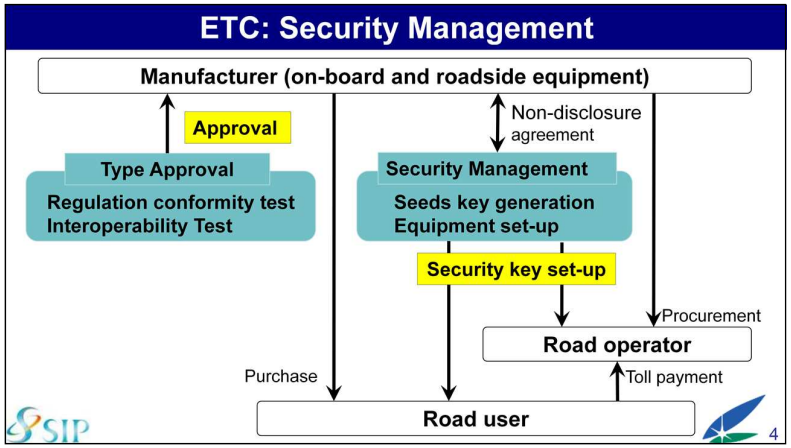
One of them is a project on automated driving systems lead by Dr. Hiroyuki Watanabe as the Program Director.



The automated driving system project is designed on the portfolio of already operating Intelligent Transport Systems.

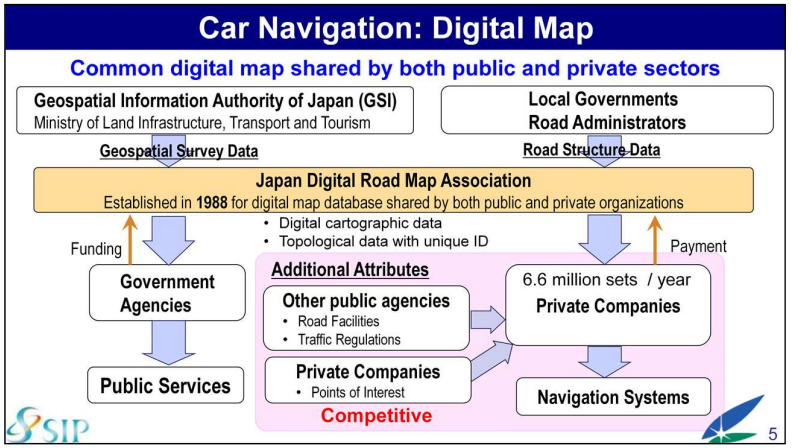
Deployment of those systems were initiated about 20 years ago in 9 areas as shown on this slide.

I'm going to review some examples from organizational point of view, which will become foundation of automated driving systems.



Nation wide operation of Electronic Toll Collection started about 15 years ago.

Two organizations are established and they have been maintaining interoperability and security, under collaboration of public and private sectors.

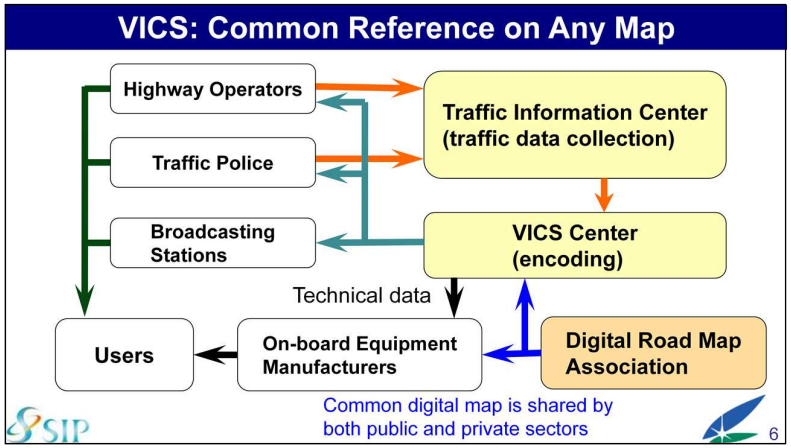


A government agency, Geospatial Authority of Japan, has database of three dimensional survey of the country.

Japan Digital Road Map Association was established in 1988 to develop and maintain a database of digital map and topological data with unique location reference ID for a variety of ITS services.

Both public and private sectors share the database as common basis and financially support the activity.

Private companies are competing by integrating additional attributes for car navigation services.

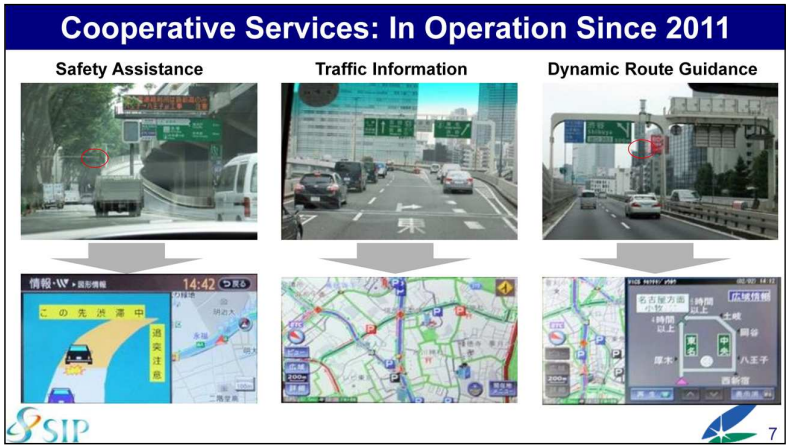


We have real time traffic information service, named VICS, started in 1996.

Traffic information from highway operators and traffic police is integrated at the Traffic Information Center.

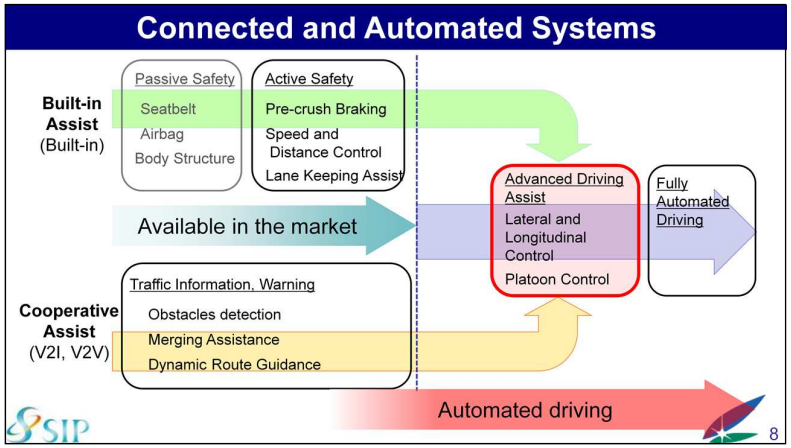
The data are coded and broadcast by VICS center.

Because common digital map and referencing scheme are shared among all the players, real-time traffic information is properly shown on any mobile terminals.



Vehicle to Infrastructure cooperative services have been in operation since 2011. We have 1,600 radio beacons on expressways and similar number on arterial roads.

Organizations created for earlier ITS deployment are integral parts of the cooperative systems.

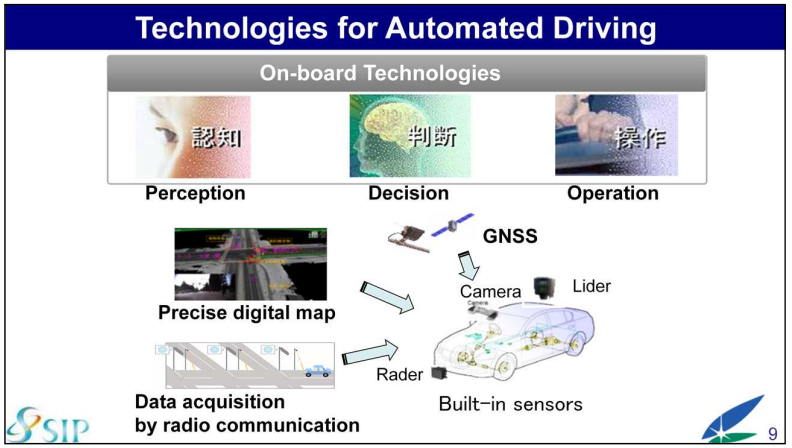


We are looking at the evolution of vehicles in this way:

Built-in features of driving assistance are already in the market and getting popular. Cooperative system have been in nation wide operation for some years.

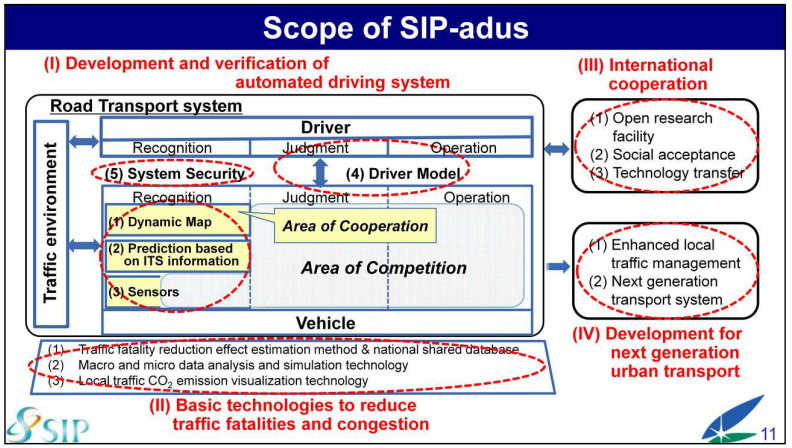
Now, those are integrated into highly automated systems and moving forward to fully automated driving.

Piecewise implementation of technologies, infrastructure and organizational structure will lead us to the feasible and sustainable automated driving systems.



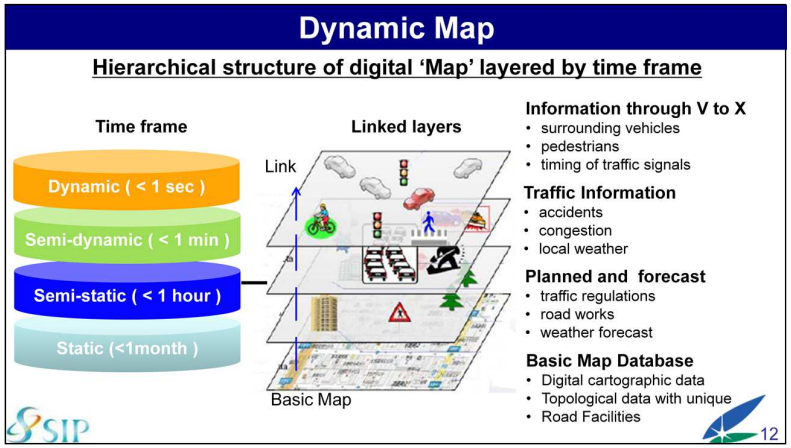
Automated driving will be realized integrating on-board technologies, precise digital map, data acquisition through radio communication and global positioning.

On-board technologies are already in product level competition. Auto manufacturers are demonstrating their technologies and announcing near future products.

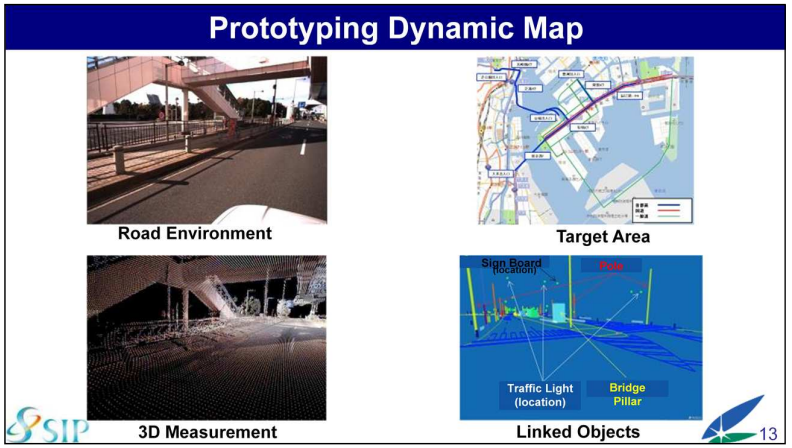


Therefore, scope of SIP-adus does not include on-board technologies nor development of prototype automated cars.

We are focusing on areas of cooperation; Dynamic Map, Connected Vehicles, Human Factors, Impact Assessment, Next generation transport, Security and international cooperation.

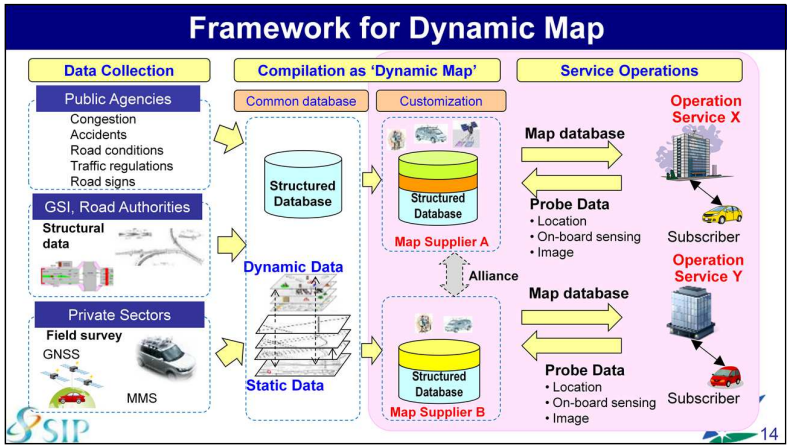


We are searching for structure of dynamic map built on shared map database. We are discussing layers with different time frame; static, semi-static, semi-dynamic and dynamic.



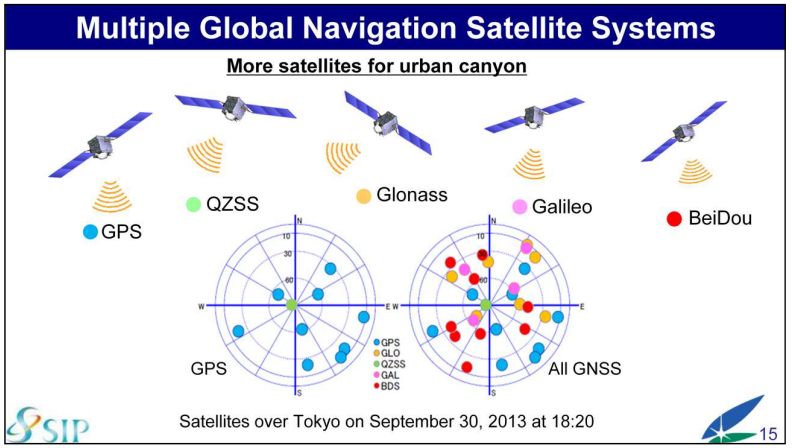
We developed a prototype of basic map layer in the target area of early deployment, Tokyo bay area.

The data are shared among the project members and being evaluated. We are going to build prototype of upper layers with semi-dynamic data as the next step.



It is also important to consider feasibility of developing and maintaining such Dynamic Map and establish business model.

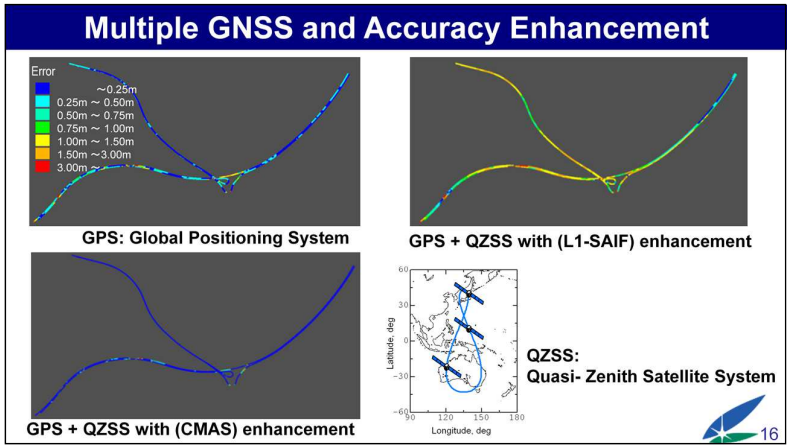
With our experiences in car navigation map, I mentioned earlier, we are discussing combination of *cooperation* to build shared common database and *competition* in the service operations with additional proprietary data.



An automated vehicle will make decision, which way to go, matching dynamic map, on-board sensor outputs and global positioning system readings.

However, sufficient number of GPS satellites are not always visible. Its accuracy is not as good as we expect.

So, we are evaluating technology options; combination of other sets of GNSS satellites and accuracy enhancement using additional signals.

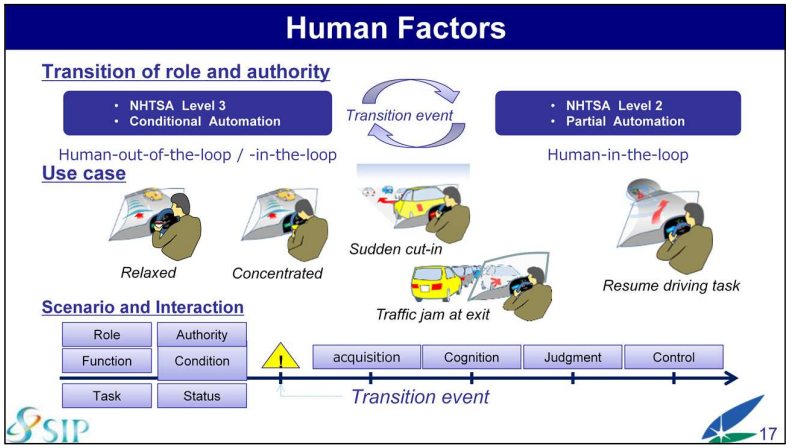


We collected data while driving a car with monitoring equipment.

On some sections of road, we obtained lower accuracy, as shown colored in yellow and red, with GPS alone.

If we combine data with those from other set of satellites, such as Quasi-Zenith Satellite System, and enhancement, we obtain better result.

We will continue searching for right balance of accuracy requirements for dynamic map, on-board sensor and global positioning system.



Human factors are also important area of cooperation.

There are transitions of roles between vehicle control system and human driver.

We identified important cases and we are analyzing a series of events, which trigger transition, along the timeline.

We are going to observe human behaviors using Driving Simulators and try to find a set of rules acceptable for both human drivers and system design points of view.

Benefits

- **Road traffic safety**
- **Environmental sustainability**
- **Universal transportation services**

with special attention to aging society

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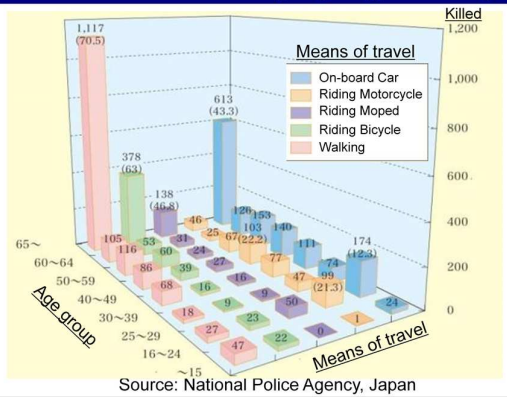
Now, I would like to talk about why we are engaging so deeply in automated driving systems, with special attention to one of the most serious challenges for Japanese society, aging and declining population.

Road Traffic Fatality by Age Group



Source: National Police Agency, Japan

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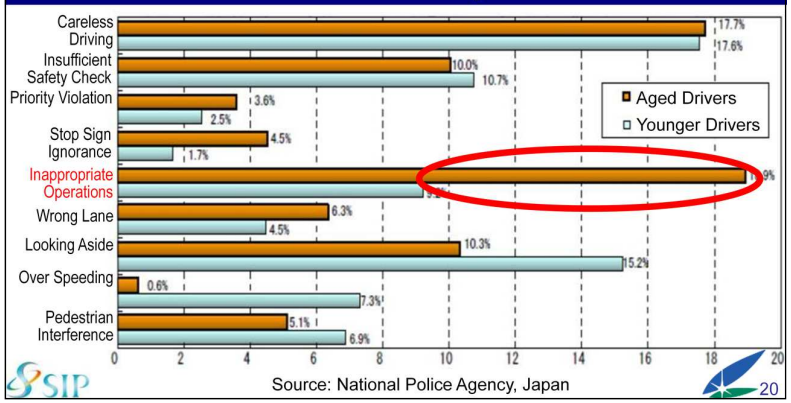
About 54% of victims of fatal traffic accidents are 65 years old or older.

Fatal Crash caused by Violation

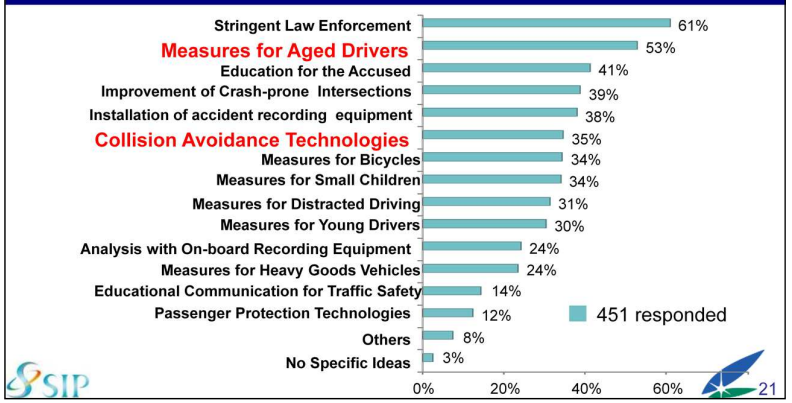


They are not only victims of the accidents but also they cause accidents.

On this chart, fatal accidents are classified by type of violations of traffic law. Brown bars represent aged drivers and light green bars represent younger drivers.

The most conspicuous is that inappropriate operations by aged drivers caused so many accidents.

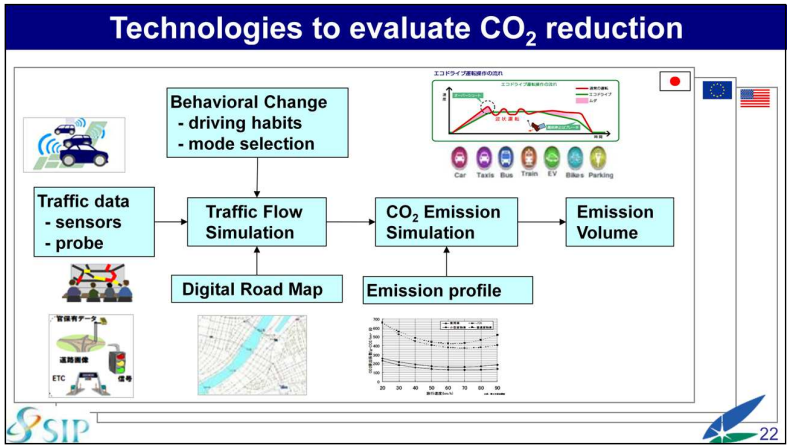
Demands from Families of Victims



National Police Agency conducted survey of families of victims of fatal traffic accidents.

They wish we had better measures for aged drivers and wider penetration of collision avoidance technologies.

Immediate application of automated technologies starting from driver assistance is our most imminent mission.

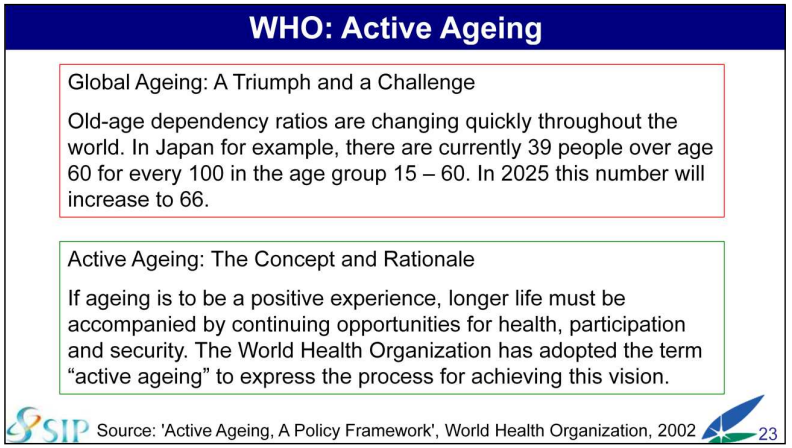


With traffic information from fixed sensors and moving vehicles combined, and detailed digital road map, we can precisely reproduce movement of each vehicle on the computer.

Then, we can get total CO_2 emission volume in the area.

Collaborating with traffic engineers from Europe and the United States, we have internationally recognized methodology.

Now, we are going to evaluate impacts of automated vehicles on energy consumption.



As I mentioned earlier, aging population is one of the most serious challenges for Japan and soon to be yours.

United Nations recognized it and proposed a policy framework; Active Aging.

Automated driving technologies are expected to contribute to give people adequate mobility for continuing opportunities to play active roles in the society.

Door to door, staying on the ground level

Mega-cities

- Comprehensive coverage of mass transit systems
- Bus transit systems and pedestrian centered road environment
- Flexible and efficient transit management

Rural towns

- Safe driving assist with automated driving technologies
- Small sized personal mobility vehicles
- On-demand public transportation feasible cost and flexibility

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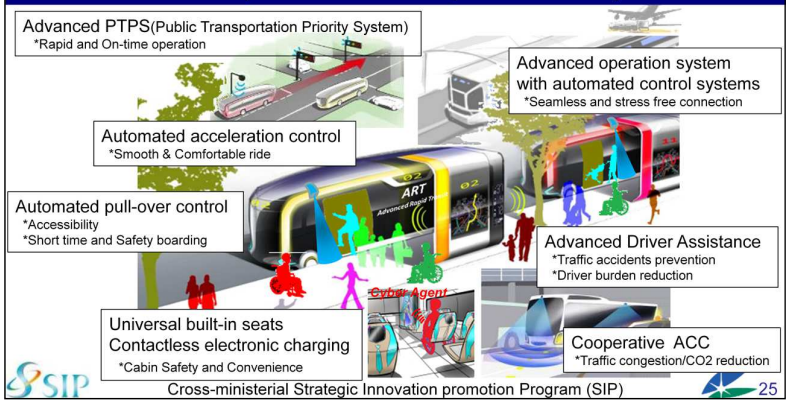
For mega cities, such as Tokyo, where comprehensive coverage of subway network exists, flexible transit system on the ground level is anticipated.

In rural areas, heavily dependent on private cars, we need safe driving assist and new compact cars for older age group to travel.

ART (Advanced Rapid Transit)



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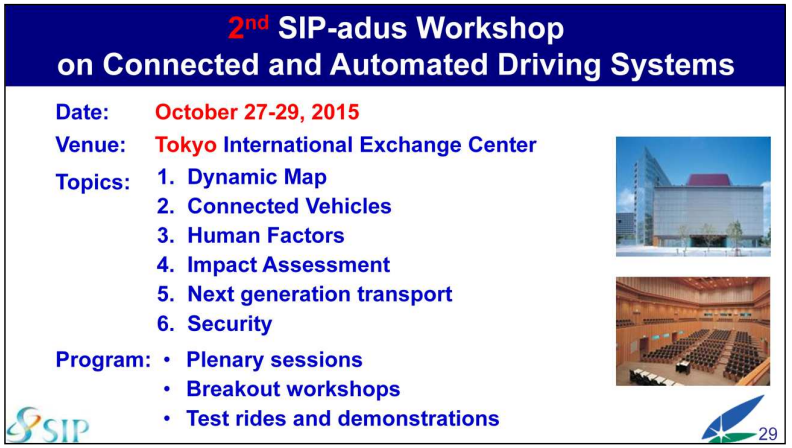
This is a conceptual image of Advanced Rapid Transit, to be deployed by the Tokyo Olympic and Paralympic Games in 2020.

We already have vehicles designed for aged people. However, I would like to stay more aggressive when I belong to active senior group, 10 years from now.

The key message from SIP-adus is 'Mobility Bringing Everyone a Smile'.

We envision an Inclusive Society, where connected and automated driving technologies provide everyone with mobility to fully exercise his or her capacity, enabling sustainable development of the society.

We hosted a workshop in Tokyo last year. It was a very successful one. We had in depth discussion on important topic shared by participants from the United States, Europe, as well as Asia-Pacific.



We are organizing the second workshop from October 27 to 29. This time, test rides and demonstrations of connected and automated vehicles are planned in conjunction with Tokyo Motor Show.

I would like to invite all of you to the second SIP-adus Workshop.