Connected and Automated Driving
Project in Japan “SIP-adus”

Takahiko Uchimura
SIP-adus  International Cooperation Working Group

November 9, 2017
Contents

- SIP, SIP-adus
- Development Structure
- Government Structure
- Technologies for Automated Driving
- Development Focus Areas
- FOT from FY2017
- International Cooperation
- SIP-adus Workshop
SIP

Cross-Ministerial Strategic Innovation Promotion Program

“SIP- adus”
- Mobility Bringing Everyone a Smile -

Innovation of Automated Driving for Universal Services
SIP Structure

CSTI
Council for Science, Technology and Innovation

Governing Board

Program Director

Promoting committee
- Program Director (Chair)
- Related Ministries
- Management agencies
- Experts from academia and public sector

Management Agency
Funding Agencies

Research Organizations
- Universities
- Private companies
- Research institutes, etc.

11 Programs
◆ Three WGs under SIP-adus

Promoting Committee

Large Scale FOT TF

System Implementation WG
◆ Technology development

Next Generation Urban Transportation WG
◆ Development and Deployment of NGUT

International Cooperation WG
◆ Communication and Cooperation
◆ Social acceptance

Dynamic Map Structuring TF
HMI TF
Governments under SIP-adus Project

- Cabinet Secretariat
  IT Strategic Headquarters
- National Police Agency (NPA)
- Road Traffic Safety
- Ministry of Internal Affairs and Communications (MIC)
  Communication Technology
- Cabinet Office
  Council for Science, Technology and Innovation
- Ministry of Economy, Trade and Industry (METI)
  Economy and Industry
- Ministry of Land, Infrastructure, Transportation and Tourism (MLIT)
  Road Bureau
  Road and Infrastructure
  Road Transport Bureau
  Standards
Trends in Japan

Traffic Fatalities

Source: National Police Agency Japan 2017
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Total</th>
<th>Vehicles</th>
<th>Motorcycle</th>
<th>Moped</th>
<th>Bicycle</th>
<th>Pedestrian</th>
<th>Others</th>
<th>Traffic Fatalities ≤30 days</th>
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<tbody>
<tr>
<td>Japan</td>
<td>2016</td>
<td>4,698</td>
<td>1,046</td>
<td>516</td>
<td>294</td>
<td>712</td>
<td>1,644</td>
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<td>France</td>
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<td>3,461</td>
<td>1,796</td>
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<td>802</td>
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<td>8</td>
<td>100</td>
<td>427</td>
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<td>USA</td>
<td>2014</td>
<td>32,675</td>
<td>11,947</td>
<td>4,422</td>
<td>172</td>
<td>729</td>
<td>4,910</td>
<td>10,483</td>
<td>32,675</td>
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</tbody>
</table>

Source: National Police Agency Japan 2017
1. **Achieve National Objectives**
   - Traffic fatalities reduction
   - Traffic Fatalities in 2016: 3,904 (≤24 hours, 4,698 ≤30 days)

2. **Implement and popularize Automated Driving Systems**
   - Technology development for Cooperative and Fundamental areas

3. **Implement Next Generation Transport System**
   - Milestone at Tokyo Olympic and Paralympic Games
R&D in Cooperative area with Industry, Academia and Government

Vehicle

<Recognition> <Judgement> <Operation>

Map, ITS info., Sensor AI Actuator

HMI

Human Machine Interface

Cooperation w/Human

Important Technologies
- Self-position estimation
- Neighboring environmental recognition

Dynamic Map

High Definition 3D Map

ITS Predictive Information

Onboard Sensors

GNSS

Laser Scanner (LiDAR)

Camera

Radar

Basic Tech. Security, Simulation, Database, etc.
Development Activities

◆ 20 to 30 projects per year

Promoting Committee
- System Implementation WG
- Next Generation Urban Transportation WG
- International Cooperation WG

Budget ￥100/$
- FY 2014: $25 M
- FY 2015: $23 M
- FY 2016: $26 M
- FY 2017: $33 M

SIP-adus’s Project (FY2015)

Dynamic Map
- Activity Plan of Dynamic Map Research for the advanced Development of Vehicle-to-Vehicle (V2V) Communication Technology
- Connected Vehicle
- Research for advanced Technology in Connected Vehicles
- Creation of an international database on connected vehicles
- Development of V2V/V2I Communication Technology
- Development of Infrastructure
- Development and FOT of Next-Generation Intelligent Cooperation Systems
- Human Factors
- Basic Research on Requirements for Future Vehicular Systems
- Research on Technical Requirements
- Impact Assessment
- Study on analytical methods in order to achieve a smooth transition to autonomous driving
- Impact Assessment
- Human Factors and HMI Research for Automated Driving

SIP-adus’s Project (FY2016)

Dynamic Map
- Surveys and investigations for Prototyping and Evaluation Toward Construction of a Dynamic Map System
- Surveying and investigation toward development of a common platform for dynamic maps
- Construction of the traffic regulation information management system for real-time automated drive prediction
- Investigation into the international standardization of Dynamic Map and Overseas Trends
- Study on utilization of satellite positioning information for realization of automated driving system
- Study and consideration to construct the ‘Dynamic Map Service Platform’

Connected Vehicle
- Establishment of the infrastructure for providing traffic signal information towards the realization of automated driving
- Establishment of technology for providing vehicle-to-vehicle/vehicle-to-infrastructure information towards the realization of automated driving
- Creation of an internationally open research and development environment
- Development of V2V/V2I Communication Technology Toward the Automated Driving Systems
- Task II Development of Vehicle-to-Pedestrian Communications + 5G Technology
- Development of Infrastructure Radar System Technology
- Next-Generation Intelligent Transport Systems (ITS) utilizing Information and Communication Technology (ICT)

Human Factors
- Human Factors and HMI Research for Automated Driving

Impact Assessment
- Study on analytical methodologies to estimate the effect of automated driving technology on reduced number of traffic accident fatalities in order to achieve the government target
- Development and substantiation of simulation technology for estimation of traffic accident reduction detailed effects (Strategic Innovation Promotion Program: Automated driving systems)
Development to FOT

**Development Structure**

- R & D Themes

**Promoting Committee**

- System Implementation WG
- Next Generation Transport WG
- International Cooperation WG

**Integrated into 5 major Topics**

1. Dynamic Map
2. Cyber Security
3. HMI
4. Pedestrian Accident Reduction
5. Next Generation Transport

**Large Scale Field Operational Test**

- Enhance Research and Technology Development
- Evaluate from various viewpoints
- Evaluate practical use
- International cooperation and harmonization
- Social acceptability

**Schedule**

- **FY2014**
- **FY2015**
- **FY2016**
- **FY2017**
- **FY2018**
Test Sites

Expressway
Tomei, Shin Tomei, Joban, Tokyo Metropolitan Expressway
Total length: approximately 300km

Arterial roads
Tokyo waterfront city area

Test facility: Jtown
JARI* Test course
New test facility for ADS (April 17, 2017 open)

(*JARI: Japan Automotive Research Institute)
Dynamic Map

**API**: Application Program Interface

**OEM**

**Link**

**3D Common Platform Data**
- Point Clouds, Graphics, Probe Data etc.

**Platform**

**Dynamic Data**
- Movement of Vehicles, Status of Pedestrians, Traffic Signals etc.

**Semi-dynamic Data**
- Accidents, Traffic Jams, Detailed Weather etc.

**Semi-static Data**
- Traffic Regulation, Road Construction, Weather etc.

**Static Data**
- High Definition 3D Map
- Road, Lane, 3D Shape of Structures etc.

**Combine various data**

**Various Uses**

**Digital Mapping**
Develop Cyber Security Evaluation Guideline

User Friendliness (JAMA)

- Common Architecture Model
- Use Cases of Automated Driving (JAMA)
- Thread Info. (JPCERT/CC, Auto-ISAC)
- Evaluation (Attack) Info. (Auto-ISAC)

Vulnerability Evaluation

- Countermeasure
- Level of Countermeasure

Cyber Security Evaluation Guideline

Threat Analysis Tool

Comparison with Current Threat Analysis (JasPar)

WiFi
Telematics
Research on 3 interactions between AV/System and Human
Mitigate Pedestrian Accidents using ITS Technologies

- V2P with mobile device
- Sensor for Vehicles and Pedestrians
- Onboard Display
- Mobile Device
- Antenna
- 79GHz radar
New Urban Mobility for easy access

- Advanced PTPS
- PTPS Roadside Detector
- Movement Restrictions Assistance Information
- Smooth Acceleration/Deceleration
- Walking Map
- Real-time Bus Operation Information
- Precise Docking Control
- Dynamic Connection Information
- Congestion Prediction
- Dynamic Connection Information

ART Information Center

Bus Operator
### FOT Schedule

<table>
<thead>
<tr>
<th>2017/ April</th>
<th>May to August</th>
<th>Sep to Dec</th>
<th>2018/ Jan to April</th>
<th>May to August</th>
<th>Sep to Dec</th>
<th>2019/ Jan to March</th>
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<tbody>
<tr>
<td><strong>Dynamic Map</strong></td>
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<tr>
<td></td>
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<td>Call for participants</td>
<td>High Definition 3D Map</td>
<td>Dynamic Map Center</td>
<td>Dynamic Data</td>
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<tr>
<td><strong>HMI</strong></td>
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<td>Call for participants</td>
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<td><strong>Pedestrian accident prevention</strong></td>
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<td><strong>Next Generation Transport</strong></td>
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<td><strong>Social Acceptance</strong></td>
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<td>Tokyo Motor Show</td>
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<td>SIP-adus WS 2017</td>
<td>Test Ride</td>
<td>SIP-adus WS 2018</td>
<td>Test Ride</td>
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</tbody>
</table>
Dynamic Map Evaluation

SIP-adus Dynamic Map

Provides Dynamic Map

Provide Feedbacks

Prepare own test vehicles

Participants

- ALPINE
- BMW
- CALSONIC KANSEI
- Continental
- DAIHATSU
- Bosch
- MAZDA
- MITSUBISHI ELECTRIC
- NISSAN
- OMROM
- PIONEER
- SUBARU
- TOYOTA

International SIP-adus Large-scale FOT

Wide Area Comprehensive
Data specification, Accuracy, Vehicle Position Detection

Sensed Data

Compare to estimate the position

High Definition 3D Map

Traffic Signs

Carriageway

Carriageway Line

Road Shoulder

GNSS

Laser Scanner (LiDAR)

Radar

Camera
Data collection and distribution method
Utility of semi dynamic information

Data Update

Utility of semi dynamic information

Traffic control
Congestion
Construction
Dropping etc.

Dynamic Map Center
• Public Information
• Semi dynamic Information to Dynamic map via I2V

Sensed Data

Compare to estimate the position

GNSS — Laser Scanner (LiDAR)
Radar — Camera

Traffic Signs

High Definition 3D Map

Carriageway
Carriageway Line
Road Shoulder
Selected based on EU and US research agenda

1. Dynamic Map
2. Cyber Security
3. Human Factors
4. Next Generation Transport
5. Connected Vehicles
6. Impact Assessment
5 major Topics
1. Dynamic Map
2. Cyber Security
3. HMI
4. Pedestrian Accident Reduction
5. Next Generation Transport

6 Focus areas
1. Dynamic Map
2. Cyber Security
3. Human Factors
4. Next Generation Transport
5. Connected Vehicles
6. Impact Assessment
Experts assigned in Focus areas

1. Dynamic Map
2. Security
3. Human Factors
4. Next Generation Transport
5. Connected Vehicles
6. Impact Assessment
**Connected Vehicles**

◆ V2V, V2I, V2P for ADV

- Sensor for Vehicles and Pedestrians
- Antenna
- Onboard Display
- Mobile Device
- Mobile Network

- Confirm gap before merging
- Start speed adjustment after V2V communication
Quantitative Analysis of Accident Reduction

Real Traffic Flow Simulation  Traffic Accident Analysis  Effect Prediction

Traffic accidents reduction simulation “Multi Agents”

Automated Driving Vehicle
Pedestrian
Manual Driving Vehicle

[Simulation Parameters]
- Levels of Automation
- Diffusion of Automated Driving Vehicle
- Error Action (driver/pedestrian)
- Traffic Flow Density
- Number of Pedestrian

Five major scenarios
- Rear End
  - Collision Warning
- Lane Departure
  - Advanced Emergency Braking
- Pedestrian Crossing
  - Lane Departure Warning
- Crossing
  - Lane Keeping Assistance
- Head-on

Simulation result
Contributions by ADVs

Accident Reduction
- Number of
  - Fatality
  - Severe Injury
  - Slight Injury
  - Near-Accident
  - Traffic Jam due to Accident
  - etc.
Workshop on Connected and Automated Driving System

http://www.sip-adus.jp(evt)/workshop2017/
◆ Specialized International Conference on AD
◆ Sharing latest information, building friendship
  ■ Attendees: 425 from 17 countries
  ■ Speakers: Total 61, 34 speakers and moderators from overseas

Topics

1. Dynamic Map
2. Connected Vehicle
3. Human Factors
4. Impact Assessment
5. Next Generation Transport
6. Security

Speakers from overseas and Minister Tsuruho

http://www.sip-adus.jp/evt/workshop2016/
## Plenary Sessions and Workshop

<table>
<thead>
<tr>
<th></th>
<th>Tuesday November 14</th>
<th>Wednesday November 15</th>
<th>Thursday November 16 (Breakout Workshop)</th>
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<tbody>
<tr>
<td><strong>AM</strong></td>
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<tr>
<td><strong>RA FOTs</strong></td>
<td>9:00 ~ 10:00 Opening Session</td>
<td>9:00 ~ 10:30 SIP-adus Report Session</td>
<td>9:00 ~ 12:00 Breakout Workshop</td>
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<tr>
<td>10:00 ~ 12:40</td>
<td>Regional Activities and FOTs</td>
<td>10:45 ~ 12:30 Impact Assessment</td>
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<td><strong>IA</strong></td>
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<td><strong>Poster Session</strong></td>
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<td><strong>PM</strong></td>
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<td><strong>DM</strong></td>
<td>13:40 ~ 14:50 Dynamic Map</td>
<td>13:30 ~ 15:15 Next Generation Transport</td>
<td>13:00 ~ 15:00 Breakout Workshop</td>
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<td><strong>CV</strong></td>
<td>15:00 ~ 16:40 Connected Vehicles</td>
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<td>15:30 ~ 17:15 Breakout Workshop Summary</td>
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<td>15:30 ~ 18:00 Human Factors</td>
<td>17:15 ~ 17:45 Closing Session</td>
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### Breakout Workshop

**Thursday November 16**

**AM**
- 9:00 ~ 12:00
  - Breakout Workshop

**PM**
- 13:00 ~ 15:00
  - Breakout Workshop
- 15:30 ~ 17:15
  - Breakout Workshop Summary
- 17:15 ~ 17:45
  - Closing Session

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**Seven Breakout Workshops simultaneously**

- RA FOTs
- DM
- CV
- Sec
- IA
- NGT
- HF

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**All Breakout Workshop attendees**

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**Breakout Workshop Summary**
◆ Opening Session
◆ Regional Activities and FOTs
◆ Dynamic Map
◆ Connected Vehicles
◆ Security
◆ SIP-adus Report Session
◆ Impact Assessment
◆ Next Generation Transport
◆ Human Factors
Speakers for SIP-adus Workshop 2017

- Opening Session
- Regional Activities and FOTs
- Dynamic Map
- Connected Vehicles
- Security
- SIP-adus Report Session
- Impact Assessment
- Next Generation Transport
- Human Factors

Speakers from Germany
◆ Regional Activities and FOTs

- Status of each region
- FOT in each region
- Issues of FOTs
- International Cooperation
- Guidance, Guidelines, Policies, Regulations, Harmonization, Standard, Ethics, etc.

Moderator
Sweden
VW/Pegasus/Germany
Renault/France
Aurora/Finland
Australia
Platooning/Netherlands
Tokyo 2020
Discussions have initiated


- Development Structure
- R & D Themes
- Promoting Committee
- System Implementation WG
- Next Generation Transport WG
- International Cooperation WG

- Integrated into five major Topics
  1. Dynamic Map
  2. Cyber Security
  3. HMI
  4. Pedestrian Accident Reduction
  5. Next Generation Transport

- Large Scale Field Operational Test
  - Enhance Research and Technology Development
  - Evaluate from various viewpoints
  - Evaluate practical use
  - International cooperation and harmonization
  - Social acceptability

POST SIP-adus
Thank you
See you in Tokyo