SIP Automated driving systems
— Mobility bringing everyone a smile —

April 04.2017
Program Director
SEIGO KUZUMAKI
Outline of SIP

- **Intensive R&D program**
  - Promote 5-years R&D (FY2014 - FY2018)
  - Enhancing cross-ministerial cooperation

- **11 research themes**
  - From societal issues such as Energy, Next-Generation Infrastructures and Local Resources, including R&D for AD

- **Leadership and total budget**
  - CSTI appointed Program Directors and allocates the budget for each research theme.
  - *\$50 billion in total per year (65% for SIP 11 themes, 35% for medical R&D)*

<table>
<thead>
<tr>
<th>adus: Automated driving systems for universal service</th>
<th>Council for Science, Technology, and Innovation</th>
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<tbody>
<tr>
<td>Governing board (CSTI Executive Members)</td>
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<td>Program Director (PD) (assigned to Cabinet Office for each policy issue)</td>
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<td>Promotion Committee (PD Chairman, relevant ministries, experts, corporations, Cabinet Office (secretariat))</td>
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<td>Relevant ministries and management corporations and other researchers</td>
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Outside experts
Goal & Exit Strategy

1. Ensuring safety and traffic jam reduction on the road
2. Realization and spread of Automated Driving System
3. Realization of advanced next generation public bus service for vulnerable people.
Technologies for Automated driving systems

Vehicle
- Recognition: Sensor, Map, ITS info.
- Judgment: Artificial intelligence
- Operation: Actuator

HMI
- HMI: Human Machine Interface
- Cooperation with Human

Basic Tech.
- Security, Simulation, Database, etc.

Dynamic Map
- A highly self-position estimation
- Neighboring environmental cognition

High-definition digital map
ITS Anticipative Information

Onboard sensor
- GSP
- Camera
- Radar

In red: Area of Cooperation ⇒ Main Area of SIP

SIP focus on the R&D in Cooperative area with Industry, Academia and Government
Dynamic Map Planning Co., Ltd. was established as a result of 2 years SIP activity.

Use Dynamic Map as an advanced traffic info. database for all vehicles, not only as a precise map for automated driving vehicle.

- Dynamic Info. (<1 sec)
  - ITS anticipative Info.
  - (V2V, V2P, traffic signal, etc.)

- Semi-dynamic Info. (<1 min)
  - Accident, Congestion, Local weather etc.

- Semi-static info. (<1 hour)
  - Traffic control, Road construction, Weather forecast, etc.

- Static Info. (<1 month)
  - Road shape, Topological data, etc.
Cyber security

① Common Models of AD for thread Analysis
② Validation/Evaluation methods and Criteria
③ Certificate Validation of V2X communication

① To establish Tread analysis
① Common architecture model
① Use cases of AD (JAMA)
② Thread Info. (JPCERT/CC, Auto-ISAC)
② Evaluation (Attack) Info. (Auto-ISAC)

① User friendliness (JAMA)

① Thread analysis tool

① Comparison with current Thread analysis (Jaspar)

② To establish Test protocols
② Countermeasure
② Level of Countermeasure

③ To reduce V2X signature

Common models

※ For specific study, closely collaborate with SIP cyber security
1) To investigate effects of system information on drivers’ behavior.
2) To investigate effects of driver state on his/her behavior in transition.
3) To investigate effective ways to functionalize AV to be communicative
Pedestrian accident reduction

Vehicle-to-Pedestrian (V2P) Communication

700MHz Direct Wireless Communication
- 700MHz band communication
- High-precision positioning
- Danger identification and pedestrian safety support

Infrastructure radar with V2I communication

79GHz band radar from roadside of intersection
Next generation Transport

ART information center

- Safe, Friendly, Smooth Transportation
- Open data
- Congestion
- Required time
- Etc.
- Priority order delivery
- Public Transportation Priority System
- On-time operation of ART
- Fixed route bus
- Seamless transits with minimum waiting time
- Information Open Platform for ART related applications

Application Examples
* Congestion Prediction
* Dynamic Connection Guidance
* Remote Diagnostics

Related Agency
Application Service Provider
Road maintenance company
Railway company
Railway, Subway
Bus service company
ART Information Center
ART Info. Center
Operational Info. Delivery
Operational Info. Center
Operational Info. Delivery
Congestion
Required time
Etc.
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Field Operational Test (FOT)

**Purpose**
1. To activate the R&D
2. To prove each elemental technology
3. To enhance international cooperation and harmonization
4. To Build Social acceptance

**Participant**
- OEM/Supplier
- University/Research organization
- Ministries, government officers
- Foreign OEM/supplier
- Journalist

**Period**
Autumn 2017 ~ beginning of 2019

**Main themes**

- Dynamic map
- Social acceptability promotion event
- HMI
- Cross subject for each themes
- Next generation urban transportation
- Information security
- Pedestrian accident reduction
Field Operational Test (FOT)

Utilize the part of the following expressway. Total: app. 300 km.

Test facility:
JARI* Test course; New test facility for ADS evaluation (Apr. 17 open)

Test site:
Arterial roads
Tokyo waterfront city area

(*JARI: Japan Automotive Research Institute)
Field Operational Test (FOT)

Dynamic Map (Example)

- To validate 3D high-resolution digital map data
- To validate data collection and distribution method
- To verify the utility of semi dynamic information

✓ The map data is provided by SIP-adus.

Map data
Spec. and Accuracy

GNSS
Lidar
Camera
Millimeter wave Radar

Semi dynamic map data utility
- Traffic control
- Congestion
- Construction
- Dropping etc.

Dynamic Map Center
- Public info.
- ITS info of Dynamic map

To validate 3D high-resolution digital map data
To validate data collection and distribution method
To verify the utility of semi dynamic information

The map data is provided by SIP-adus.
Field Operational Test (FOT)

HMI (Example)
- To collect and analyze the driver state data
- To define driving readiness status and driver
- Verification of HMI methods and devices.

Cyber Security (Example)
- To validate the evaluation method
- Inspect defense functions of ADV

Layer 1: Communication of Out Car
Layer 2: E/E Architecture
Layer 3: In Car Bus Protocol
Layer 4: ECU Software Structure
A common base platform (map, rule etc.) is necessary for keeping safety and the social order. ⇒ Promoting harmonization and standardization
Thank you for kind attention!