Our Recent Activities Toward Connected Car Society

Koji Hara
Assistant Director, ITS Promotion Office, Ministry of Internal Affairs and Communication (MIC)
Current Autonomous News in Japan
Japan’s Hayabusa2 Spacecraft Lands on Ryugu Asteroid

The probe ascended from the space rock after firing a bullet to help with the gathering of samples that will eventually be returned to Earth.

17h ago • By MICHAEL ROSTON and KENNETH CHANG

Congratulations on your successful touchdown, @hayabusa2_jaxa! We’re excitedly waiting for the telemetry and confirmation of sample collection.
C-ITS Japan
ETC, an Electronic Toll Collection System using DSRC in 5.8 GHz band
Data of ETC (5.8GHz DSRC)

There are, 89,684,000 ETC units on vehicles

In 2018, ETC were used 8,000,000 times per day

2,950,000,000 times per year

cf. Population In Japan
15~64: 76 million
65~: 35 million
ITS Connect (700MHz DSRC)

V2I

Ambulance 2 V

CACC
ITS Connect (Japan’s V2X) in Asia
Cross-Ministerial Project
Public-Private Autonomous-driving Partnership Roadmap

Owner Car

Mobility Services

Safety Assisting

General Road

Highway

Local Area

Expand Area

Platooning

Field Operational Test

2020

2020’s

2025

Lv2

Lv3

Lv4

Lv2

Lv2

Lv4

Lv4

Lv4

Lv4

2019/3/4-6
SIP-adus Field Operational Test

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

**Overview**

- **General information**
  - Traffic information
  - high definition 3D maps in the dynamic maps, etc
- **the Haneda Airport area**
  - Magnetic makers
  - provisional bus stops etc.
- **Metropolitan Expressway Routes**
  - information for merging highway main lane
  - Information for passing through ETC gates.

**Schedule**

<table>
<thead>
<tr>
<th>FY 2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>prepare</td>
<td>1st Term FOT</td>
<td>prepare</td>
<td>2nd Term FOT</td>
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</table>

**Place**

- Tokyo Waterfront City Area
- Haneda Airport Area
- Metropolitan Expressway

10th ETSI ITS Workshop 2019/3/4-6
AIM of SIP-adus FOT

Arrangement for FOT utilizing Traffic Environment Info

FOT on Actual Environment

Verification and Agreement among Participants toward Standardization

Traffic Signal Information
- General
- Exclusive

ETC Gate / Merging Assist Information
- Exclusive

Traffic Environment Info for Each Lane
- Exclusive

High resolution 3D Map
- General
- Exclusive

ETC2.0 equipment

ITS antenna

FOT on Actual Environment

VERIFICATION ITEM

Protocol for Info

Info Link Method (by P/T ref)

Priority of Infrastructure

Deliver Method (Wireless System)
We envision the verification of transportation services and automated driving by privately owned vehicles in mixed traffic environments which contain intersections, have pedestrian and bicycle traffic, and include ordinary, non-autonomous vehicles.

**<Technologies to be verified>**

* Intersection driving support using delivered traffic signal information
* Driving using high-accuracy 3D map information
* Assessment of impact of infrastructure collaboration automated driving on road transport
* Assessment of locations of traffic infrastructures needed for automated driving (wireless ITS spots delivering signal information, etc.)
We envision the verification of unmanned transportation services, etc., in limited areas, such as airports, using infrastructure collaboration automated driving control such as public busses and small transport vehicles

<Technologies to be verified>

* Automated driving technologies for achieving accessibility and comfort
* Bus speedy transportation and regularly scheduled transport support using PTPS (Public Transportation Priority Systems)
* Intersection driving support using delivered traffic signal information
* Assessment of locations of traffic infrastructures needed for automated driving (wireless ITS spots delivering signal information, etc.)
This test is envisioned for merging from ordinary roads to highways and diverging from exit interchanges to ordinary roads, etc.

**<Technologies to be verified>**

* Driving support using road-to-vehicle integration such as information provision of merging support and ETC gates on highways
* Delivery of road traffic information by lane on highways
* Driving using high-accuracy 3D map information
<Roles of participants>

✓ Prepare autonomous vehicles, etc.
✓ Verify infrastructure collaboration automated driving technologies using loaned test equipment
✓ Report test results and data.

>> in FOT participant working group meetings
✓ Help decide on collaborative area technology specifications
✓ Share opinions related to a state of road-to-vehicle collaboration, and standardized specification.

<Overview of test equipment>

✓ The test equipment will be lend out to receive information distributed via the infrastructure collaboration systems in this test.
✓ Refer to the "Participation Rules for Tokyo Waterfront City Area Field Operational Test" regarding the division of duties involved in preparing test equipment.
✓ Details regarding the information supplied by the infrastructure collaboration systems (output formats, information provision locations, etc.)
✓ Details regarding test equipment will be provided as necessary by the Secretariat or the contractor at participant briefings, progress report meetings, information-sharing sessions, etc.
5G for Automated driving
Mobility Services with 5G

- **enhanced Mobile Broad Band** (eMBB)
  - Movie appreciation
  - Enjoy Sports

- **Ultra Reliable & Low Latency Communication** (URLLC)
  - Truck Platooning
  - Remote Driving

- **massive Machine Type Communication** (mMTC)
  - Tele-work
  - Tele-examination

- Dynamic Map Distribution
  - Static
  - Semi-Dynamic
  - Semi-Static
  - Dynamic

- Pedestrian Support

Applications:
- Movie appreciation
- Enjoy Sports
- Tele-work
- Tele-examination
- Remote Driving
- Truck Platooning
- Ultra Reliable & Low Latency Communication (URLLC)
5G movie

Soccer game in Live VR

Of course, Autonomous Driving

Smart concierge supports us

Vehicle moves to pick-up next Passenger

Payment will be done automatically

He came here to meet his Grand parents

Why?
<table>
<thead>
<tr>
<th>Technology</th>
<th>Responsible Organization</th>
<th>Main Partners</th>
<th>Trial Overview</th>
<th>Main Trial Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>eMBB</strong> (4.5, 28GHz)</td>
<td>NTT DOCOMO</td>
<td>• TOBU TOWER SKYTREE</td>
<td>• AR·VR content</td>
<td>• Kyoto</td>
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<td></td>
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<td>• ALSOK (Security)</td>
<td>• Monitoring and Security</td>
<td>• Gunma</td>
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<td></td>
<td></td>
<td>• Fukui Pref.</td>
<td>• Medical Services</td>
<td>• Tokushima</td>
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<td>• Wakayama Pref.</td>
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<td>• Wakayama</td>
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<tr>
<td></td>
<td></td>
<td>• Aizu-Wakamatsu City</td>
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<tr>
<td><strong>eMBB</strong> (4.5, 28GHz)</td>
<td>NTT Communications</td>
<td>• Tobu Railways</td>
<td>• Transport (High speed railway)</td>
<td>• Ibaraki</td>
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<tr>
<td></td>
<td></td>
<td>• West Japan Railway Company</td>
<td></td>
<td>• Tokyo</td>
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<tr>
<td></td>
<td></td>
<td>• Infocity (Contents Company)</td>
<td></td>
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<tr>
<td><strong>eMBB</strong> (28GHz)</td>
<td>ATR (Research Corporation)</td>
<td>• Kyushu Institute of Tech.</td>
<td>• Smart factory</td>
<td>• Fukuoka</td>
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<td></td>
<td></td>
<td>• Keikyu Railways</td>
<td>• Station</td>
<td>• Haneda Airport</td>
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<td></td>
<td></td>
<td>• Waseda Univ.</td>
<td>• School education</td>
<td>International Terminal Station</td>
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<td></td>
<td></td>
<td>• Maehara elementary school</td>
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<td><strong>URLLC</strong> (4.5, 28GHz)</td>
<td>Softbank</td>
<td>• Advanced Smart Mobility Corp.</td>
<td>• Transport</td>
<td>• Shizuoka</td>
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<td></td>
<td></td>
<td></td>
<td>• Car remote control</td>
<td></td>
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<tr>
<td><strong>URLLC</strong> × <strong>eMBB</strong> (3.7/4.5, 28GHz)</td>
<td>KDDI</td>
<td>• Obayashi Corp. (Construction)</td>
<td>• Remote Construction</td>
<td>• Osaka</td>
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<tr>
<td></td>
<td></td>
<td>• NEC (Appliance manufacturer)</td>
<td>• Drone surveillance</td>
<td>• Nagano</td>
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<td></td>
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<td>• The Univ. of Tokyo.</td>
<td></td>
<td>• Hiroshima</td>
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<tr>
<td><strong>mMTC</strong> (4.5GHz)</td>
<td>Wireless City Planning</td>
<td>• Pacific Consultants (Construction consultant)</td>
<td>• Smart highway</td>
<td>• Aichi</td>
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<td></td>
<td></td>
<td>• NICT (National Institute)</td>
<td>• Smart office</td>
<td>• Hiroshima</td>
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<td></td>
<td></td>
<td>• Higashihiroshima City</td>
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20 Part of 5G Trial in FY2018

10th ETSI ITS Workshop 2019/3/4-6
5G Trials: Truck Platooning

Shin-Tomei Highway

5G Truck Platooning

CACC by NR-V2V

Base Station

CACC by NR-V2V

Redundancy
- DSRC
- Opt. WC

10th ETSI ITS Workshop
Technological Examination toward the Connected Car Society
High speed/hot-spot communication (e.g. DSRC, Millimeter-wave)

(1) Vehicle Management (data driven services)
- Vehicle management, operation management, vehicle insurance, ride sharing, car sharing, payment, regional monitoring

(2) Safety (driving support services)
- Safe driving support, automated driving support, driver monitoring, traffic flow optimization

(3) Infotainment (entertainment services)
- Movies and other entertainment services, virtual passenger VR

(4) Assistant for driver
- Emergency information, roadside assistance, concierge services

Convenience and comfort

Highly reliable/direct communication (e.g. DSRC)

Probe information

Wide area communication (LTE, 5G, etc.)
To meet the requirements of communication for connected vehicle, this project will find out the way to advance the current ITS wireless systems (760MHz band DSRC) and coexistence with other wireless systems.

V2I: Emergency Hazard Information Distribution
V2V: Emergency Hazard Information Distribution
V2I: Emergency Hazard Information Collection
V2V: Emergency Hazard Information Redistribution
V2I: Main lane Vehicle Information Distribution
V2V: Running Information Exchange between Main lane vehicle and Merging Vehicle
V2I: Merging Vehicle Information Distribution

Refer to UCs considered by Japan Automobile Manufacturers Association, Inc. (JAMA) in January 2018.
New V2X technology such as application of cellular technologies are discussed all over the world. This project will investigate the feasibility of introducing new V2X technology.
To realize new communication (e.g., exchange image, video, 3D map), demands for large capacity communication for connected vehicles are increasing. This project will investigate the possibility of large capacity millimeter-wave communication for V2X.

**V2I (Vehicle to Infrastructure)**
- Safety support; blind spot video shearing
- Instant contents delivery; 3D map etc.
- Huge data collecting; recorded driving data

**V2V (Vehicle to Vehicle)**
- HD image/sensor sharing; platooning trucks
- Instant data sharing; surrounding road conditions

- Radar/Lidar
- Sensor sharing
- HD Video streaming
- Forehand
- Sensor data
- Road conditions
One of the big themes to realize connected vehicles society is how to manage data. We will have to manage rapid expanding data for new services provided in Connected Car Society.

For Connected Car Society, a new platform to integrate various wireless systems and manage data is necessary. This project investigates, develops and demonstrates the prototype of such platform.
Wireless system may have cyber security risk for Connected Vehicle Society, if we do not tackle this issue.

This project will examine the security risks and investigate the requirements for secure wireless systems.
Trials: Alerting invisible vehicle at an Intersection

- Feasibility of New DSRC System and WiGig for V2X will be verified in the use case “Alerting Invisible Vehicle at an Intersection”
- New DSRC alerts vehicle by V2V, WiGig sends the video in V2I
Trials: Warning obstacle to Following Vehicle

- Feasibility of New Cellular System and WiGig for V2X will be verified in the use case “Warning obstacle to Following Vehicle”
- LTE-V2X warns following vehicle by V2V and V2I, WiGig sends the video image in V2V and V2I
Thank you for Listening