SIP-adus Activities Report

—Connected Vehicles—

Cross-Ministerial Strategic Innovation Promotion Program

Innovation of Automated Driving for Universal Services

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<Translated Version>

Table of contents

1. Overseas trends in automated driving using V2X

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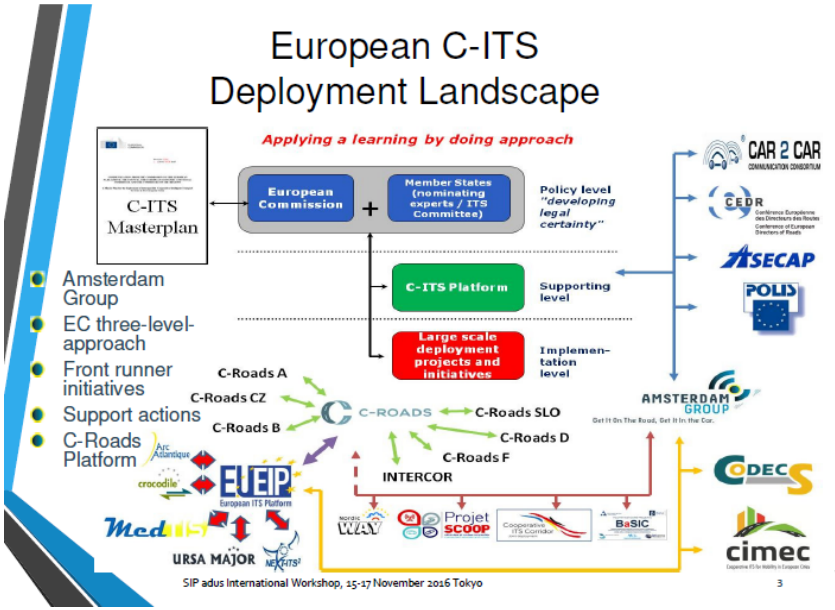
Summary of topics

・Trends in Europe

・Various projects such as C-ITS are actively moving forward
・**Field operational tests** are being conducted as part of projects related to automated driving



Source：SIP-adus homepage

・Trends in the US

・ Connected vehicles (CV) pilots as a **V2X field operational test** projects are starting to move forward in the context of **driving safety support**
・The passing of a bill related to **mandatory vehicle-to-vehicle (V2V) installation requirements** would at once accelerate the development of cooperative intelligent transportation systems (ITS)
・Developments related to communication-based automated driving **still slow**

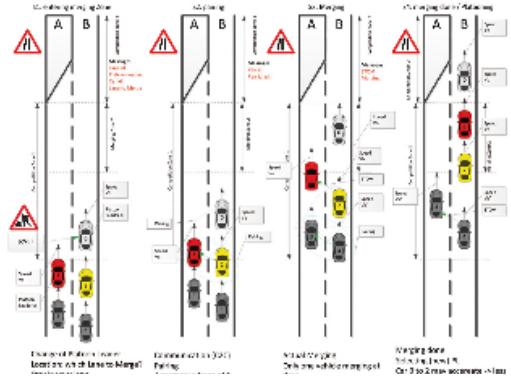
Connected vehicles Pilot Deployment Program

Source：US DOT homepage

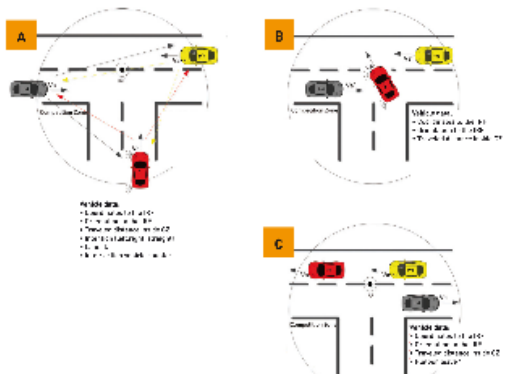
1-1. Trends in Europe

2016.5.28-30 i-GAME event

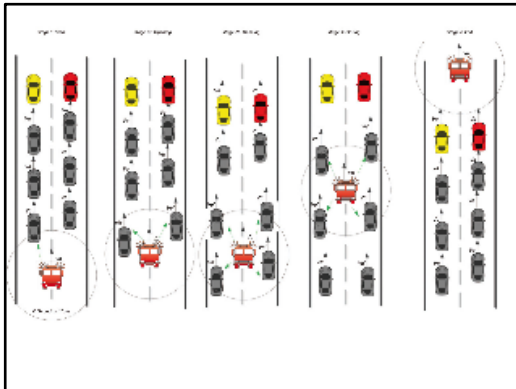
- ✓ **Field operational test** for automated driving **on public roads** based on **cooperative ITS system**
- ✓ Verification of ITS-G5 (5.9GHz DSRC) **communication performance and interoperability**
- ✓ Development of control logic based on three usage cases
- ✓ Production of test vehicle by university students from six countries



Scenario: Changing lanes



Scenario: Merging into intersection



Scenario: Avoiding emergency vehicle

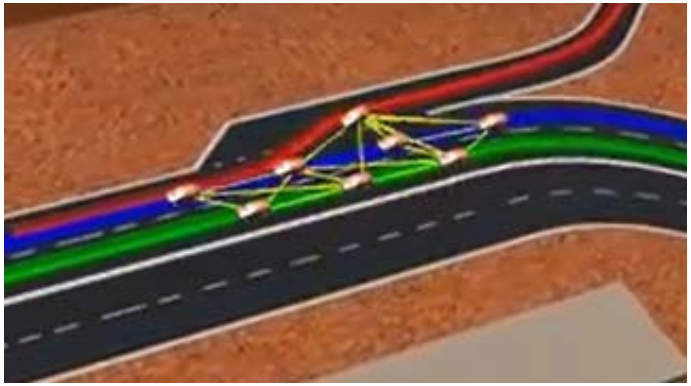
Source: i-GAME homepage

1-1. Trends in Europe

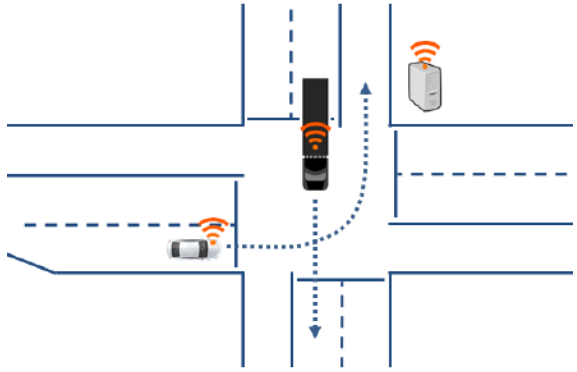
2016.10.27 AutoNet2030 Final Workshop

- ✓ Usage case such as breaking way, merging, and urban intersections when platooning
- ✓ Development of vehicle control, communication formats, and human machine interface (HMI)
- ✓ Experiments in simulations and test courses

ASTA ZERO experiment



Highway merging simulation



Entering urban intersection

Source: AutoNwt2030 homepage

1-2. Trends in the US

Connected vehicles Pilot Deployment Program (CV Pilot)

New York City

New York City DOT Pilot

- Reduction in urban **accidents involving pedestrians**
- Confirmation of vehicle-to-infrastructure (V2I), V2V, and vehicle-to-pedestrian (V2P) technology effects in field operational tests
- Plan to incorporate communication equipment into 5,800 vehicles, 1,250 buses, 400 trucks, 310 traffic lights, and 100 pedestrian

Tampa

Tampa-Hillsborough Expressway Authority Pilot

- Reduction in urban **traffic congestion**
- Leverage V2V and V2I to prevent rear-end collisions, accidents involving pedestrians, **driving in wrong direction**
- Plan to to incorporate communication equipment into 1,500 vehicles, 20 buses and trolleys, 40 roadside units, 500 pedestrian(smartphones)

Wyoming

Wyoming DOT Pilot

- **Strong wind accident countermeasures** for trucks driving on highways
- Provision of weather information through V2I and V2V
- Plan to incorporate communication equipment into 75 roadside units (600km), and 400 trucks and other vehicles

1-2. Trends in the US

Legislation of installation of in-vehicle V2V equipment

V2V Notice of Proposed Rulemaking

NHTSA proposal to regulate vehicle-to-vehicle (V2V) communication technology for new light vehicles in the United States.

The distinct functional components are:

- The actual communications technology itself
- Proposed messaging format and content requirements
- Authenticating V2V messages
- V2V device misbehavior detection and reporting
- Malfunction indication requirements
- Software and certificate updating requirements
- Proposed cybersecurity related requirements

https://www.safercar.gov/v2v/index.html

U.S. Department of Transportation
ITS Joint Program Office

10

2. Development status for SIP-adus Connected Vehicles

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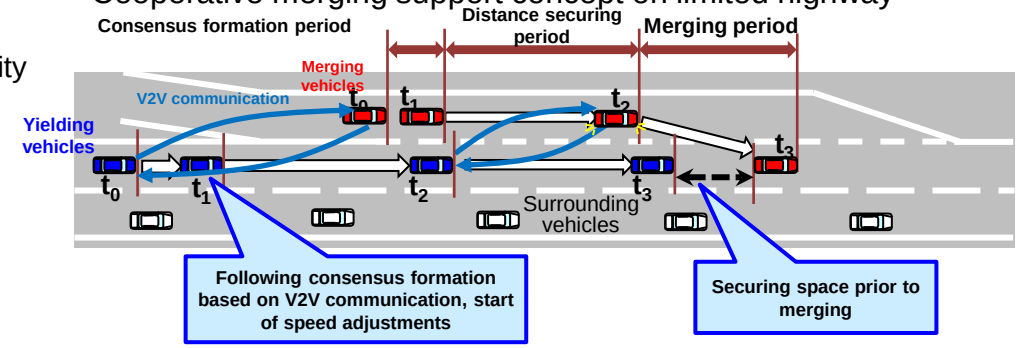
—Development of V2V and V2I communication technology—

Examination of communication performance and look-ahead information model required for the **smooth realization of automated driving**

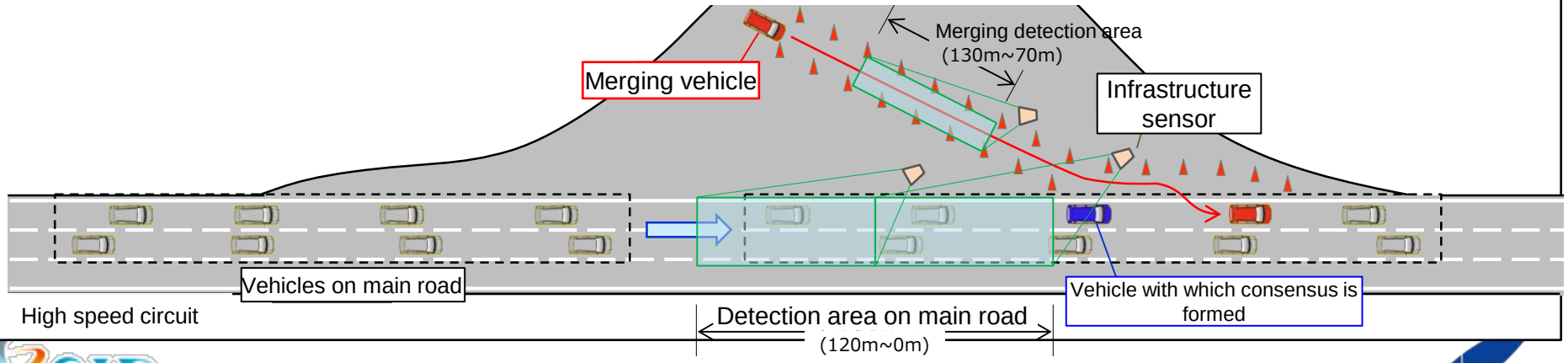
a. Development of technology that can address issues when applying 700MHz band ITS communication to automated driving usage case

- Technology to expand communication capacity
- Stabilization of communication quality

Cooperative merging support concept on limited highway



b. Examination of utilization of V2V and V2I communication in merging user case



2. Development status for SIP-adus Connected Vehicles

—Development of V2P communication technology—

Appropriate identification of surrounding conditions by Automated driving vehicle and reduction in **accidents involving pedestrian and bicycle etc.**

1) Stabilization of pedestrian positioning accuracy

■ Progress status: ±**5m accuracy**

- Error removal technology using satellite positioning
- Complementation with Pedestrian Dead Reckoning (PDR)
- Complementation with satellite doppler

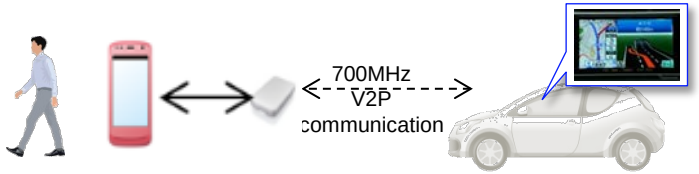
Error removal technology using satellite positioning only

Additional correction through PDR, etc.

2) Development of pedestrian terminals

■ Progress status: Trial production of safety support app
Basic operation confirmed

- Development of **risk assessment/HMI**
- Miniaturization of antennas and measures to counter radio wave interference
- Reduction in power consumption



Proto type of pedestrian terminals and in-vehicle equipment with a view toward field operational tests

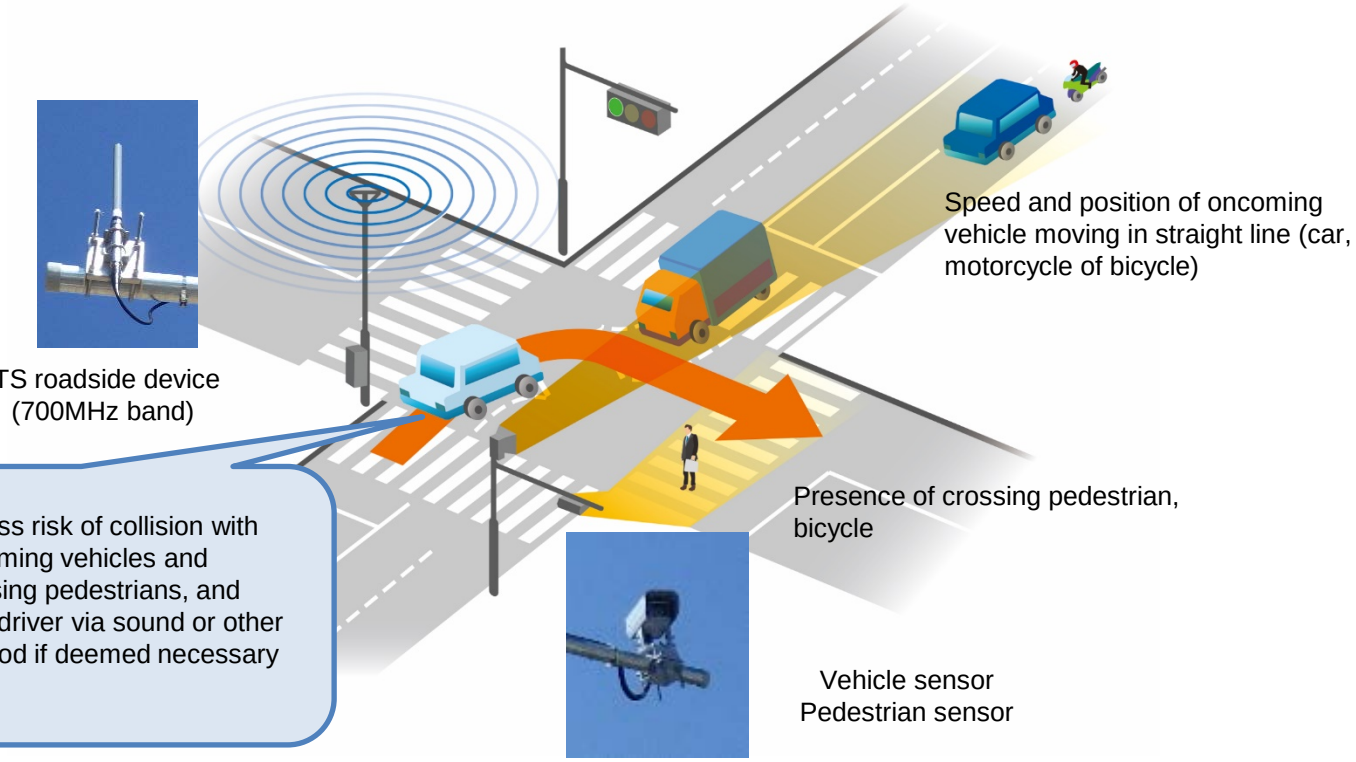
2. Development status for SIP-adus Connected Vehicles

—Development of Driving Safety Support Systems (DSSS) that utilize radio waves—

Establishment of vehicle and pedestrian warning technology in intersection with a view toward realizing automated driving

Summarize types of moving objects (vehicles, pedestrians, bicycles, etc.) that should be detected by safe driving assistance and automated driving systems, as well as the detection area, and examine the performance of sensors, etc., required for detection.

[Overview of systems that support the prevention of collisions to on coming vehicles and oversight of pedestrians crossing the road during right turn]



3. SIP-adus Workshop: Sharing of information on outstanding issues

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Overview of Breakout Workshop

The Breakout Workshop **shared information** and discussed **outstanding issues** related to member activities (five members from Europe, nine members from Japan) with the aim of realizing V2X that supports automated driving).

Outstanding issues

- Promotion of infrastructure deployment
  - Cost burden ownership
- Communication specifications and frequency
  - DSRC vs 5G
  - DSRC vs Wifi
- Usage cases
- Standardization of communication specifications

Breakout Workshop

4. Summary

4. Summary

1. Europe: Start of automated driving field operational tests using communication
   Japan: At stage of basic research of application to automated driving
   US: Strongly promoting deployment of safe driving support

2 . In SIP-adus, potential for applying 760MHz DSRC to automated driving through technology that verifies usage case of merging into highway, reduces accidents involving pedestrians, and prevents collision accidents at intersections.

3. In SIP-adus Breakout Workshop, continue to share information on general trends and outstanding challenges with overseas experts

Thank you for your attention.