Smartway Project
Cooperative Vehicle Highway Systems

AHB30, 2006 TRB annual meeting

National Institute for Land and Infrastructure Management, Japan

Hiroshi MAKINO
• **Where has significant progress been made?**
  ITS enter second stage in Japan
  To realize a DSRC platform capable of various ITS services in 2007

• **Where are the future opportunities?**
  VICS (Congestion)  ⮞  ETC  ⮞  Safety & Multiple usage

• **What are the keys to success?**
  Platform (esp. OBU)
  Infrastructure go first (Congestion and Safety)
    Public RSU  ⮞  OBU  ⮞  Private RSU  ⮞  OBU expanding

• **What are the major obstacles?**
  Consensus to develop infrastructure
  Cooperation between Public and Private sectors
## 1. Smartway Project

### 1) ITS Enter the Second Stage in Japan

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Details</th>
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<tbody>
<tr>
<td>August 2004</td>
<td>Smartway Project Advisory Committee - &quot;Proposal “ITS Enter the Second Stage - Smart Mobility for All - &quot;&quot;</td>
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<td></td>
<td>To realize a platform capable of various ITS services. Those services to be realized in 2007.</td>
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<td>October 2004</td>
<td>Japan ITS Promotional Conference - &quot;ITS Promotion Guideline&quot;</td>
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<td>December 2004</td>
<td>Japan Productivity Center for Socio-Economic Development</td>
<td>&quot;Towards Realization of Intellectual Transport Services Through Deployment and spread of ITS&quot;</td>
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<td>March 2005</td>
<td>Development Bank of Japan - &quot;Present State and Future Outlook for Advancing ITS&quot;</td>
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<td>July 2005</td>
<td>Japan Society of Civil Engineers - &quot;Towards ITS Effective for Roadways (Interim Report) – From Seeds to Public Benefits&quot;</td>
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<td>July 2005</td>
<td>Smartway Project Advisory Committee - Announcement of &quot;Follow-up Proposal and Interim summery of Joint Research&quot;</td>
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</table>
1. Smartway Project

2) Overall Picture of Smartway
1. Smartway Project

3) Platform Deployment Strategy “Key is common OBU for ITS”

- **1995 - 2001 - 2007**

**Services promoted by the public sector**
- Next-generation roadway services
- Information provision services along roadways
- Information connection services such as at roadside rest areas
- Public parking lot settlement services

**Deployment of private services**
- Information services
- Payment services for gasoline stations, drive-thru establishments, etc.
- Recreational services
- Vehicle diagnostic services
- and many others

- **Digital Road Map**
  - Car navigation
  - VICS
    - 2.4GHz beacons
  - ETC
    - 5.8GHz DSRC
  - Information provision
  - Fee collection
  - Next-generation roadway services

- **Car navigation**
  - ITS
    - VICS
    - ETC
    - IC Credit Card
    - Internet
    - Uplink
    - 5.8GHz DSRC

- **Diverse media**
  - 1995 2001 2007
1. Smartway Project

4) Spread of services on platform
1. Smartway Project

5) Smartway Project concerned organizations

Joint research public and private sectors

Study of technologies for providing government services using DSRC

MLIT
Ministry of Land Infrastructure and Transport

NILIM
The National Institute for Land and Infrastructure Management

Private corporations

23 firms

ITS Japan
ITS (Intelligent Transport Systems) Japan

AHSRA
Advanced Cruise-Assist Highway System Research Association

Public sector applications

Private sector applications

RSU
Road-vehicle communications

ITS OBU

HIDO
Highway Industry Development Organization

ARIB
Association of Radio Industries and Businesses

JARI
Japan Automobile Research Institute

Private corporations and organizations

223 firms and organizations

DSRC Forum Japan

Examination and proposal of specific policies for proliferation of DSRC application services
2. Joint Research for Next-Generation Services

1) Schedule of the Joint Research

- Feb. 2005: Joint research Start
- July 2005: Interim report
- Feb. 2006: Demo 2006
- End of Fy2005: Final report

Joint research between public and private sectors
23 Private Sectors

- Aisin Aw Co., Ltd.
- Clarion
- Denso
- Fujitsu
- Fujitsu Ten
- Fujitsu Laboratories
- Hitachi
- Japan Radio Co., Ltd.
- Kenwood
- Mitsubishi Electric
- Mitsubishi Heavy Industries
- NEC
- Nissan
- NTT DoCoMo
- Oki
- Panasonic
- Park 24 Co., Ltd.
- Pioneer
- Sumitomo Electric
- Tokico Technology Ltd.
- Toshiba
- Toyota
- Xanavi
2. Joint Research for Next-Generation Services

2) Realization of ITS services by 2007

Joint research

Development of standards and specifications

Installation of RSE and manufacture of OBU

Realization of ITS services

2004

Smartway Project Advisory Committee

Joint Research office

2005

2006

2007

Deployment of RSE & OBU

Congestion 2 km ahead due to an accident between Urayasu and Makuhari.

Urayasu to Makuhari: 2 km congestion due to an accident.
2. Joint Research for Next-Generation Services

3) Configuration of the Platform

- GPS
- ITS OBU
  - Car Navigation Function
  - Digital Road Map
  - Basic API
- 5.8GHz DSRC
- Road-to-Vehicle Communication Functions
- RSU
  - Basic API
  - Applications
  - Road-to-Vehicle Communication Functions
## 2. Joint Research for Next-Generation Services

### 4) Characteristics of 5.8 GHz DSRC

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Summary</th>
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<tr>
<td>Already used for ETC</td>
<td>8.6 million vehicles equipped&lt;br&gt;Usage rate around 50%&lt;br&gt;“Spreading in the future”</td>
</tr>
<tr>
<td>High level of security</td>
<td>Enabling payment services</td>
</tr>
<tr>
<td>High speed &amp; large capacity</td>
<td>Enabling safety services</td>
</tr>
<tr>
<td>Internet connection</td>
<td>Enabling various services (esp. Private Sector)</td>
</tr>
<tr>
<td>Two-way communication</td>
<td>Enabling information collection by uplink function</td>
</tr>
<tr>
<td>Spot communication</td>
<td>Enabling easy development and deployment</td>
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</table>
2. Joint Research for Next-Generation Services

5) Basic API on DSRC

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command &amp; response</td>
<td>Notification of instruction information from RSU to OBU, and response by OBU</td>
</tr>
<tr>
<td>Memory access</td>
<td>Reading and writing of memory from RSU to OBU</td>
</tr>
<tr>
<td>ID communications</td>
<td>Identification of OBU by RSU and response by OBU</td>
</tr>
<tr>
<td>Card access</td>
<td>Sending and receiving of IC card settlement information between OBU and RSU</td>
</tr>
<tr>
<td>“Push-Type” information</td>
<td>Provision information from roadside units to on-board units</td>
</tr>
<tr>
<td>Security</td>
<td>“Mutual authentication,” “Data authentication,” and “Encoding” functions to ensure application reliability and safety</td>
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</table>

Combination of Basic API functions makes various ITS services on public and private.
2. Joint Research for Next-Generation Services

6) Realization of ITS services by 2007

(1) Information provision services “Improvement of VICS”

Wide range of information

Information by voice

- Congestion 2 km ahead due to an accident between Urayasu and Makuhari.

Information on greater numbers of jam routes

Information by static image

- Icy road surface ahead.

Collection of Probe data

High speed and High capacity communication

Urayasu to Makuhari: 2 km congestion due to an accident.
2. Joint Research for Next-Generation Services

6) Realization of ITS services by 2007

(2) Information connection services at rest area “Internet Connection”

Top page of WEB

Road traffic information

Road surface conditions

Local news

IP protocol connection

On-board display

DSRC antenna

Testing at Showa Michi-no-eki
May 3–5, 2005
2. Joint Research for Next-Generation Services

6) Realization of ITS services by 2007
   (3) Public parking lot settlement services “IC credit card payment”

- High speed and secure communication
- IC credit card access

Fee payment testing at Ozone parking facility
3. Development of “AHS” for Safety

1) Role of Cooperative Systems

Collision safety
Preventive safety
Safety countermeasures by the independent vehicle

“Towards zero accidents”

* Intersection, curve, etc

(source: Toyota Motor Corp.)
3. Development of “AHS” for Safety

2) Role of the AHS

Role of AHS

Difficult to recognize by the vehicle
- Highways: curves, etc.
- Arterials: near intersections

Accidents occurring over a wide range (utilization of maps, etc.)
- Arterials: intersections, etc.

Detection by infrastructure

Targets of AHS

Using Maps and Navi.

Degree of accident concentration

No. of locations where accidents occur

Targets of AHS Based on Accident Rates
3. Development of “AHS” for Safety

3) Services Targeted for Realization in the 2nd Stage

Highway safety corp. with ASV
(Ex: Support for prevention of collisions with forward obstacles)

Navigation for elderly drivers
(Ex: Intersection safety information services)

Utilization of uplinks
(Ex: Road surface information services)

Congestion mitigation
(Ex: Leading to the proper use of lanes at sag sections)
4) Role of Road-Vehicle Cooperation and Procedure for Introduction

Introduction Procedure

First . . .

Non-intersections*

Static information

Road-vehicle cooperation

AHS-i

Then . . .

Intersections

Dynamic information

Vehicle-Road-Vehicle / Vehicle-vehicle cooperation

AHS-c, a

Application to road administration and Traffic information management

* Non-intersections: Straight sections, curves, etc.
3. Development of “AHS” for Safety

5) Roadmap of Road-Vehicle Cooperation

Driver-Oriented Services
- Soft infrastructure
- Non-Intersection Services
- Intersection Services
- Traffic flow smoothing

No-Intersection Services (operational support, etc)
- Operational support
- Warning support

VICS beacons
- Preparing of maps, databases, etc.

VICS beacons
- Operational support
- Warning support

Infra-structure Side

Deployment of information technologies on roads

Vehicle-side

Advanced vehicle control
Inter-vehicle communication

ITS OBU 6.8GHz platform

Vehicle control

Car navi. system with VICS

ETC

Preparation of maps, databases, etc.
Road information infrastructure

Road sensors, road surfaces sensors
DSRC probes
(Data) Collection infrastructure

ETC
5.8GHz DSRC
(information) Provision Structure

AHS -i
AHS -c
AHS -a

Heavy vehicle control
- The analysis of traffic accident causal, congestion factor
- Road surface management support
- Structure management support

Accident detection and assessment
- Traffic congestion monitoring

Operational support
Warning support

AHS -i
AHS -c
AHS -a

(staffed area) Automatic driving

Road-management Oriented Services

- Non-Intersection Services
- Heavy vehicle control
- The analysis of traffic accident causal, congestion factor
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Operational support
Warning support

AHS -i
AHS -c
AHS -a

(staffed area) Automatic driving

3. Development of “AHS” for Safety
4. Developing new services on the platform

ITS into the 2nd Stage!

- Map downloads
- Cashless payment
- AHS
- ITS services in 2007
  - Information provision along roadways
  - Information connection at rest areas
  - Public parking lot settlement
- Platform
  - More efficient road administration
  - Creating business opportunities
  - Greater business efficiency
- Restaurants
- Convenience stores and supermarkets
- Dispatch control
- Traffic control

- Private parking facilities
- Gas stations

Information provision along roadways
Information connection at rest areas
Public parking lot settlement
Smartway Demo 2006

• **Date**  
  22-24 February 2006

• **Location**  
  NILIM Test Course

• **Contents**  
  Demo of various ITS services on the Common DSRC OBU
  • New VICS services: AHS, TTS, Image
  • IP connection service
  • Parking settlement service
  • V-R-V services: Merging support
  • Gas station payment service
  • Push information services: Highway Radio, Parking guidance, etc
Thank you very much for your attention.

Contact information

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