What’s Happening Overseas?
International Perspective on Safety
Applications for Connected Vehicles
CRASH AVOIDANCE

• Front and rear crush zones absorb impact forces
• Comprehensive use of high-strength steel helps direct energy away from the passenger compartment
• Antilock brakes, front and rear with audible wear indicator
• Brake transmission shift interlock
• Brake Assist
• Automatic Daytime Running Lamps
• Automatic exterior lamp control
• Disc brakes, front and rear, audible wear indicator
• Door warning lamps or reflectors
• Fog lamps (optional)
• Halogen headlamps
• Window defoggers
• Inside auto-dimming rearview mirror
• Outside power rearview mirrors (power heated, auto-dimming)
What’s Happening Overseas for Connected Vehicles?

- **Japan**
  - Smartway
  - Energy ITS
  - Sky

- **Europe**
  - Private Sector
  - European Commission
    - Current projects
    - Outlook
  - National projects
Japan
SmartWay

- **Mobility / Efficiency / “soft safety”**
- **Key Applications**
  - Information on Obstacles Ahead
  - Information on Conditions Ahead
  - Merging Assistance
  - Map-linked Services
  - Smart Parking
  - Internet Connection
1. Feature of Smartway
New Cooperative Road-Vehicle Systems

Smartway: New Cooperative Road-Vehicle Systems

- ITS on-board units
- Stand alone type
- Car navigation linked type
- 5.8 GHz DSRC (Dedicated Short Range Communications)

Source: Japan MLIT
1. Feature of Smartway
Realizing Various Services by Road-Vehicle Cooperative Systems

**Information supply services**
- Providing traffic information
- Providing driving safety support information
- Management of special vehicles and vehicles carrying hazardous substances
- Bus location systems

**Information access services**
- Information access at rest areas
- Information access at service areas and parking areas
- Information downloads
- Ad distribution

**Fee collection services**
- ETC
  - Parking fee payments
  - Gas station payments
  - Drive-through payments
  - Car ferry payments

**Spot communications services (DSRC services)**

**ETC services**

**Applied services**
- In-car online shopping
- Facility entrance/exit management
- Monthly lease parking facility entrance/exit management
- Various types of customer management

Progressive deployment of services for safety, peace of mind, comfort, and convenience in a variety of situations where vehicles are used

Source: Japan MLIT
2. Field Operational Tests

“ITS-Safety 2010” Large-Scale FOT in Tokyo

Road Bureau, MLIT: Smartway

- V2I communication in expressway by radio wave (DSRC)
- Caution! Merging vehicle from the left.

National Police Agency (NPA): DSSS

- V2I communication in ordinary road by radio communication media, such as infrared beacons
- Infrared beacon
- Traffic signal ahead!

Road Transport Bureau, MLIT: ASV

- V2V communication by radio wave (5.8GHz, 700MHz)
- Priority road
- V2V communication
- Stop sign
- Subject vehicle
- Non-Priority road
- Driver stops proceeding
- Provide information on existence of approaching vehicles
- Through vehicle

Source: Japan MLIT
ITS-SAFETY2010 Deployment Plan

- 1035 roadside units (IR beacons)
- 15B yen (about $150M)
- Service starting April 2010

Initial focus: verification of effectiveness
- Monitoring driver behavior specific to situation
- Included infrastructure-based measurement of vehicle movements
- 2000 drivers
Initially Nissan, now additional OEMs have now joined

Using VICS IR beacon for communication
- all V2I / I2V

Applications
- Intelligent Speed Advisory (school zones)
- Intersection Collision Avoidance
- Pedestrian Awareness using Mobile Phone
- Dynamic Route Guidance using Probe Data
- Opposite Direction Driving Prevention
- Skid Incident Information Service
Nissan Product in Cooperative Safety

- Press release July 2009
  - 2010 Fuga model
- Applications
  - Warning approaching low visibility intersection (stop sign/traffic signal)
    - IR beacons
  - School zone alerts
  - Navigation-linked speed control
    - Curves, toll-gates
  - Probe data
“Energy ITS” Project

- Objectives: CO2 emission reduction
- Period: 2008 – 2012
- Funding: METI & NEDO, about 5 billion yen in 5 years
- Themes
  - Automated vehicles and automated platoon
  - Evaluationing effects of ITS on CO2 emission reduction
- Contractors
  - Japan Automobile Research Institute
  - Universities, research institute, private companies
### Concept of Vehicle Platooning

Three-version Concepts according to Aims and Target Dates

Image based on graphics supplied by Central Nippon Expressway Co.

<table>
<thead>
<tr>
<th>Major conditions</th>
<th>Concepts I &amp; II</th>
<th>Concept III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim</td>
<td>Fuel-saving platooning in mixed traffic</td>
<td>Automated platooning on main expressways with exclusive lanes</td>
</tr>
<tr>
<td>Platooning type</td>
<td>A platoon of 2 or 3 vehicles</td>
<td>A platoon of 3 or more vehicles</td>
</tr>
<tr>
<td>Driver presence</td>
<td>Drivers present in all platooning vehicles</td>
<td>A driver present in the leading vehicle only</td>
</tr>
<tr>
<td></td>
<td>The driver's role: Partial driving operations, safety check, emergency operations</td>
<td>The driver's role: Safety check, emergency operations</td>
</tr>
<tr>
<td>Required technology</td>
<td>Auto-driving control, vehicle ambient recognition, etc.</td>
<td>Auto-driving control, drive reliability technology, etc.</td>
</tr>
</tbody>
</table>
CFD Result of 3 Truck Platoon of 4m Gap at 80 km/h

Vehicle 3
Vehicle 2
Vehicle 1

Mean of Normalised Pressure

Mean of Velocity: Magnitude (m/s)
European Projects

PRIVATE SECTOR PROJECTS
EUROPEAN PROJECTS
NATIONAL PROJECTS
• Promoting cooperative systems for safety
• Defining open European industry standard for a Car2Car communication system
• Enabling an open system supporting active safety applications plus information services
• Developing deployment strategies
• Developing business models to speed up the market penetration
• Major demo in 2008 provided driver warnings:
  o urban crossroads with line-of-sight obstruction when a motorbike is approaching
  o construction sites
  o disabled vehicles
European Commission:
Significant R&D Investment in Crash Avoidance

- History
- Current Projects
- Future Outlook
European Commission Information Society Directorate
R&D in the 6th and the 7th FP

2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013

14 projects 80 M€ grant
22 projects 92 M€ grant
14 projects 57 M€ grant
12 projects 48 M€ grant
Budget: 53 M€
Budget: 37 M€

Intelligent Vehicles & Mobility Services
Moving to Cooperative Systems
Safety & Energy Efficiency in Mobility
Mobility of the Future

Call 1
Call 4
Call 1
Call 2
Call 4
Call 6

Source: European Commission

Work programme to be prepared
Major EC-Funded Cooperative Systems Projects

- **Cooperative Vehicle-Infrastructure Systems (CVIS)**
  - 70M euro
  - 60 partners
  - Cooperative vehicle highway systems
  - Both safety and non-safety applications

- **SafeSpot**
  - 49M euro
  - 20 partners
  - Stronger focus on vehicle-vehicle communications for safety

- **COOPERS**
  - 16.8M euro
  - Brings together road operators to focus on cooperative systems
  - Non-low-latency soft safety plus mobility applications

- **INTERSAFE2: Cooperative Intersection Safety**
  - 6.5 M euro
<table>
<thead>
<tr>
<th>Framework Program</th>
<th>Project</th>
<th>Funding Level (euros)</th>
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<tbody>
<tr>
<td>6th Framework First Call</td>
<td>PReVEnT</td>
<td>~70.0 M</td>
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<td>AIDE (adaptive HMI)</td>
<td>12.4 M</td>
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<td>Cybercars 2</td>
<td>4.2 M</td>
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<td>6th Framework Cooperative Systems Call</td>
<td>CVIS</td>
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<td>SAFESPOT</td>
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<td>COOPERS</td>
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<td>SEVECOM</td>
<td>5.3 M</td>
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<td>TRACE</td>
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<td>FeedMAP</td>
<td>3.7 M</td>
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<td>eIMPACT</td>
<td>2.7 M</td>
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<td></td>
<td>eSafety Support</td>
<td>2.0 M</td>
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<tr>
<td></td>
<td>COMeSafety</td>
<td>1.8 M</td>
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## OEM & Major Supplier Participation in Selected European Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Audi</th>
<th>BMW</th>
<th>Daimler</th>
<th>Ford Europe</th>
<th>Ford/ Jaguar</th>
<th>Ford/ Volvo</th>
<th>GM/ Opel</th>
<th>GM/ Saab</th>
<th>Fiat</th>
<th>PSA</th>
<th>Renault</th>
<th>VW</th>
<th>Volvo Trucks</th>
<th>Bosch</th>
<th>Continental</th>
<th>Hella</th>
<th>Siemens</th>
<th>TRW</th>
<th>Valeo</th>
<th>Other</th>
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<td>AIDE HMI</td>
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<td>Car2Car CC</td>
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<td>SAFESPOT</td>
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- ● = core partner, • = associated partner
CVIS

- Multi-media seamless connectivity
- Significant pre-deployment of roadside infrastructure
- Test sites in
  - France
  - Germany
  - Italy
  - Netherlands/Belgium
  - Sweden
  - UK
CVIS: Vehicle-infrastructure communications
(CVIS in blue shading)
SAFESPOT

The SAFESPOT CONCEPT:
from the autonomous intelligent vehicle...

... to intelligent Cooperative Systems

Source: SAFESPOT
Communications: low-latency DSRC at 5.9 GHz
Application focus is crash-avoidance safety
  - “softer” safety than USDOT program
  - non-crash imminent scenarios (2+ seconds)
SAFESPOT works closely with CVIS for interoperability

<table>
<thead>
<tr>
<th>Application</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Intersection Safety</td>
<td>Lateral Collision - LATC</td>
</tr>
<tr>
<td>Lane Change Manoeuvre</td>
<td>Longitudinal Collision - LONC</td>
</tr>
<tr>
<td>Safe Overtaking</td>
<td>Road Departure - RODP</td>
</tr>
<tr>
<td>Head On Collision Warning</td>
<td></td>
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<tr>
<td>Rear End Collision</td>
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<tr>
<td>Speed Limitation and Safety Distance</td>
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<tr>
<td>Frontal Collision Warning</td>
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<tr>
<td>Road Condition Status – Slippery Road</td>
<td></td>
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<tr>
<td>Curve Warning</td>
<td></td>
</tr>
<tr>
<td>Vulnerable Road User Detection and</td>
<td>Vulnerable Road Users - VURU</td>
</tr>
</tbody>
</table>
The communication framework

**CALM**
Support of ITS and Internet Services based on continuous communication over 802.11, GSM, UMTS, IR, IPv6, etc.

**CVIS**
V2V and V2I communication when no routing is needed

**Car2Car protocol**

- **SAFESPOT**
  - For V2V and V2I communication, based on geo-aware multi-hop routing
  - Candidate technology: IEEE 802.11p
  - Need for dedicated frequency band in the 5.9 GHz range for secure V2V and V2I, avoiding interference with existing consumer links

**V2V and V2I communication for safety and traffic efficiency applications using Car2Car and CALM technologies**
COOPERS

- COOPERS (COOPerative SystEms for Intelligent Road Safety)
- Road operator focus for cooperative systems
- Non-low-latency soft safety plus mobility applications
- Testing conducted public motorways in France, Belgium, the Netherlands, Germany, Austria, and Italy.
COOPERS Information Exchange

- **I2V:**
  - Traffic jam warning and guidance, including alternate routes
  - Weather alert information
  - In-car display and alert of area-specific speed limits, including intelligent speed adaptation
  - Lane specific, selective ban of trucks
  - Estimated time of arrival, based on current traffic situation on the network
  - Car breakdown/emergency services

- **V2I:**
  - Floating car data
COOPERS Communications Media

- Broadcast Media
- DAB (Digital Audio Broadcast)
- DVB-H (Digital Video Broadcast Handheld)
- Cellular Communication Media
- GPRS (2.5G Cellular Networks)
- WiMAX (Metropolitan Area Networks)
- Short-range Communication media
- Infrared (CALM IR)
- Microwave (5.9GHz)
See CVIS / SAFESPOT / COOPERS Live!!!

Connecting Smart Vehicles with Intelligent Infrastructure

HOW THE DEPLOYMENT OF COOPERATIVE SYSTEMS FOR EUROPE
WILL ENHANCE ENERGY EFFICIENCY, SAFETY AND MOBILITY

23-26 March 2010 Amsterdam RAI, The Netherlands

The “connected vehicle” is no longer a dream, and the “intelligent transport infrastructure” is already appearing on Europe’s roads. Brought together through a new generation of mobile communication technologies, they make up the future world of “Cooperative Mobility”. For four days in March 2010, the combined results of three major European R&D projects, CVIS, SAFESPOT and COOPERS, will be showcased in Amsterdam.
Intersection Collision Avoidance: INTERSAFE2

- **3 Demonstrators**
  - 2 passenger cars (VW, BMW) and
  - 1 heavy good vehicle (VTEC truck)
- **Bidirectional V2X communication**
- **Cooperative sensor data fusion**
- **Relative intersection localisation**
- **Intersection object tracking and classification**
- **Risk assessment and warning/ intervention strategies**
- **2 Test sites (Germany & Sweden)**
New EC Projects in Near Term

- Current call for proposals closes in April
- New projects expected to start late 2010
- Major cooperative systems FOT(s) expected
EC Long Term Strategy

- 8th Framework Program starts ~2014
- “European Large Scale Actions” -- ELSA
  - focused projects of significant scale and duration
  - cutting across the innovation cycle
  - developing modern pan-European service infrastructures
- Key focus: transport
EC Long Term Strategy

- Transport ELSA
  - Freight and logistics
  - ICT for clean and efficient mobility
  - Fully electric vehicles and associated infrastructure
  - Cooperative systems for safety
  - Assisted and automated driving
    - Better traffic flow and CO2 emissions reductions
German Projects

- Funded by German Ministry of Research or Ministry of Economy and Technology (not Transportation Ministry)
- AKTIV (60M euro)
  - World-leading work in ADAS and CVHS.
  - Driver assistance and traffic management are emphasized.
  - The traffic management work is aimed at reducing traffic jam risk by 15% while increasing traffic capacity by 10%.
- CoCar (4M euro)
  - Developing cooperative applications based on cellular communications
    - Using newest cellular technology with message latencies as low as 80 ms
- SIM-TD (53M euro)
  - Safe Intelligent Mobility - Test Platform
  - focusing on vehicle-to-vehicle and vehicle-to-infrastructure communication
    - 802.11p and cellular protocols
    - soft safety applications
Netherlands Projects

- Major FOT is underway for heavy trucks
  - 2500 vehicles
  - Basic active safety systems (non-cooperative)
- Grand Cooperative Challenge stimulating work in cooperative systems (TNO)
  - Support from Dutch Ministry of Economic Affairs
  - Modeled on U.S. DARPA Challenges
  - Planned for 2011
  - www.gcdc.net
Contrast with USA

- USA leads with the focus on crash-imminent crash avoidance supported by communications
  - Automatic actuation within 1 second or much less
  - “Most stressing requirements” will stimulate a wide range of applications
- Japan / Europe initial focus on “developing crash situations”
  - Advisories several seconds ahead of potential event
  - Walk before you run?
A Final Word:
Check Out “Thinking Cars”

- One hour TV documentary
- Produced by H3B Media
- Funded by European Commission
- Intended for broadcast (2010?)

Watch the trailer!
www.thinkingcars.com

Questions?
richardbishop@mindspring.com