Connected Vehicle Research in the United States

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Connected Vehicle Concept

Drivers/Operators

Vehicles and Fleets

Connectivity

Wireless Devices

Infrastructure
What is the Connected Vehicle Program?

- Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) wireless communications for:
  - Crash prevention
  - Improved mobility
  - Environmental sustainability
- Connected vehicle capability addresses over 80% of unimpaired crash scenarios
- Encompasses autos, buses, and trucks
  - Partnership among RITA, NHTSA, FHWA, FMCSA, and FTA
What is the Connected Vehicle Program (cont.)

- Uses Dedicated Short-range Communications (DSRC) technology
  - FCC-dedicated spectrum at 5.9 GHz
  - Low latency and high reliability essential for safety applications
  - Other communications types being considered for non-safety applications (e.g. cellular, Wi-Fi)
Key Program Objectives

- 2013 - NHTSA Decision on Vehicle Communications for Safety (light vehicles)
- 2014 - NHTSA Decision on Vehicle Communications for Safety (heavy vehicles)
- 2015 - FHWA to issue Infrastructure Implementation Guidance
NHTSA Agency Decision

Possible decision options include:

- **Rulemaking** on minimum performance requirements for vehicle communications for safety on new vehicles
- Inclusion in NHTSA’s **New Car Assessment Program** to give car makers credit for voluntary inclusion of safety capability in new vehicles
- **More research** required
▪ NHTSA’s action for the 2013 decision will be based on hard data:
  ▫ Simulation and modeling efforts based upon previous field operational tests
  ▫ Data collection from V2V test track testing
  ▫ Empirical data obtained from Safety Pilot
    ▪ Driver clinics (user acceptance)
    ▪ Model deployment activities (safety effectiveness)
ITS Research Program Components

Applications
- Safety
  - V2V
  - V2I
  - Safety Pilot
- Mobility
  - Real Time Data Capture & Management
  - Dynamic Mobility Applications
- Environment
  - AERIS
  - Road Weather Applications

Technology
- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

Policy
- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues
Safety Pilot Objectives

- Generate empirical data for supporting 2013 and 2014 decisions
- Show capability of V2V and V2I applications in a real-world operating environment using multiple vehicle types
- Determine driver acceptance of vehicle-based safety warning systems
- Assess options for accelerating the safety benefits through aftermarket and retrofit safety devices
- Extend the performance testing of the DSRC technology
Safety Pilot Sites

- Driver clinics
  - Assess user acceptance

- Large-scale model deployment
  - Obtain empirical safety data for estimating safety benefits
User Acceptance -- Driver Clinics

- 6 locations across the U.S. beginning in August 2011
- 100 drivers per location
- Experience crash warnings
  - Forward Crash Warning
  - Emergency Brake Light
  - Blind Spot Warning
  - Lane Change Warning
  - Intersection Assist
  - Do Not Pass Warning
Model Deployment

• Major road test and real-world implementation in 2012-2013, involving:
  □ Approximately 3,000 vehicles
  □ Multiple vehicle types
  □ Fully integrated systems and aftermarket devices
  □ Roadside infrastructure
  □ System-wide interoperability testing

• Also to test
  □ Prototype security mechanisms
  □ Device certification processes
Roadside Equipment for Safety Pilot

- Transmission and receipt of V2I messages
  - Interfaces with signal controller (at intersections)
  - Supports other dangerous road segment applications

- Applications supported
  - CICAS-V (red-light warning)
  - Curve overspeed warning
  - Collection of probe data transmissions
  - Other (tbd)

- 4 vendors currently developing RSE prototypes
Test Environments - Build a Reference Implementation

Status:

- Test beds with interoperable equipment in California, Florida, New York, Michigan, and Virginia, and network operations in Tennessee

2012 to 2013

- Reflect the system architecture
- Utilize harmonized international standards
- Implement a certification process
- Implement a security process
Policy Research Focus

- Security Needs and Privacy
- Deployment Scenarios/Business Models
- Governance
Critical Security Questions

- Which communications media can support the needs for distributing security certificates? Choices include:
  - Dedicated Short Range Communications (DSRC) - may require up to 40,000 RSEs
  - Existing Cellular Networks or Wi-Fi – infrastructure exists but must address privacy
  - Vehicle-Based Security Option (no infrastructure)

- What are advantages and limitations of each?

- How should the organizational functions of security certificate distribution and management be structured?
  - Who should be responsible for them
  - How should they be funded initially and over time?
V2I for Safety Program

- Requires infrastructure, could be implemented at spot locations:
  - Intersections (tied into traffic signals)
  - Curves

- Enabling Technologies
  - Signal Phase and Timing
  - Positioning
  - Communications
  - Mapping

- Applications
  - Intersection safety (e.g. red light warning)
  - Speed warnings at curves, school zones, or works zones
  - Pedestrian Safety
Mobility Program

Real-time Data Capture and Management

- Vehicle Status Data
- Infrastructure Status Data
- Weather Data
- Truck Data
- Transit Data

Dynamic Mobility Applications

- Reduce Speed
  - 35 MPH
- Transit Signal Priority
- Weather Application
- Real-Time Travel Info
- Fleet Management/
  Dynamic Route Guidance
- Signal Phase &
  Timing Adjusts
  Real-Time Conditions
- Safety Alerts
  and Warnings
AERIS Program

- Applications for the Environment: Real-time Information Synthesis
- Identified Transformative Applications
  - Eco-Signals
  - Eco-Lanes
  - Low Emissions Zones
  - Support for Alternative Fuel Vehicle operations
  - Eco-Traveler Information
- Planning a public workshop March 14-15 in Washington, DC to further discuss data and other requirements for Apps
  - Registration information and draft agenda to be developed and circulated soon
For More Information

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