Connected Vehicle Overview

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Today’s Transportation Challenges

Safety
• 32,367 highway deaths in 2011
• 5.3 million crashes in 2011
• Leading cause of death for ages 4, 11-27

Mobility
• 4.8 billion hours of travel delay
• $101 billion cost of urban congestion

Environment
• 1.9 billion gallons of wasted fuel

ITS Strategic Research Plan 2010-2014

• **Vision:** To research and facilitate a national, multimodal surface transportation system that features a connected transportation environment around vehicles of all types, the infrastructure, and portable devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance

• Plan developed with full participation by all surface transportation modal administrations, as well as with significant interaction with multimodal stakeholders

• 2012 Progress Update recently completed
Fully Connected Vehicle

Vehicle Data
- latitude, longitude, time, heading angle, speed, lateral acceleration, longitudinal acceleration, yaw rate, throttle position, brake status, steering angle, headlight status, wiper status, external temperature, turn signal status, vehicle length, vehicle width, vehicle mass, bumper height

Infrastructure Messages
- Signal Phase and Timing
- Fog Ahead
- Train Coming
- Drive 35 mph
- 50 Parking Spaces Available
Technology for Safety – 5.9 GHz DSRC

- **What it is**
  - Wi-Fi radio adapted for vehicle environment
  - Inexpensive to produce in quantity
  - Original FCC spectrum allocation in 1999
  - FCC revised allocation in 2004 and 2006

- **How the technology works**
  - Messages transmitted 10 times/sec (300m range – line of sight)
    - *Basic Safety Message*: vehicle position, speed, heading, acceleration, size, brake system status, etc.
    - Privacy is protected (vehicle location is **NOT** recorded or tracked)

- **Benefits of DSRC technology compared to radar/laser technology**
  - Reduced price
  - Improved reliability → fewer false alarms
  - Increased performance → addresses more crash scenarios

- **Drawback of the technology**
  - Both vehicles need to be equipped to gain benefit
  - Requires security infrastructure
# ITS Research Program Components

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Connected Vehicle Safety

• NHTSA Agency Decisions
  – 2013 NHTSA agency decision on V2V safety communications systems
  – Similar milestone in 2014 for a decision regarding V2V safety technology on heavy vehicles
  – Information to support the decisions will come from many sources, including the Safety Pilot Model Deployment

• Policy work
  – System security
  – Privacy
  – Governance
  – Business Models
  – Legal Issues
Safety Pilot Model Deployment

- 2800 vehicles (cars, buses, and trucks) equipped with V2V devices
- Provide data for determining the technologies’ effectiveness at reducing crashes
- Includes vehicles with integrated safety applications and others that use aftermarket devices (i.e., not built into the vehicle)
- Applications to be tested include:
  - Blind Spot Warning/Lane Change Warning
  - Forward Collision Warning
  - Electronic Emergency Brake Lights
  - Intersection Movement Assist
  - Do Not Pass Warning
  - Control Loss Warning
Moving towards Infrastructure Deployment

- Defined Safety (V2I), Mobility (V2V & V2I), AERIS and Weather Apps
- NHTSA Decision: Light Vehicles
- NHTSA Decision: Heavy Vehicles
- FHWA Deployment Guidelines
- Pilots/Early Deployments
- Application Development
- 2011: Defined V2V Apps
- 2012: NHTSA Decision
- 2013: NHTSA Decision
- 2014: FHWA Deployment Guidelines
- 2015: Pilots/Early Deployments
- 2016: Application Development
Connected Vehicle Applications

**SAFETY APPS (V2V)**
- Forward Collision Warning (FCW)
- Emergency Electronic Brake Light (EEBL)
- Intersection Movement Assist (IMA)
- Blind Spot Warning (BSW), Lane Change Warning (LCW)
- Left Turn Across Path / Opposite Direct

**SAFETY APPS (V2I)**
- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Stop Sign Violation
- Railroad Crossing Violation Warning
- Spot Weather Impact Warning
- Oversize Vehicle Warning
- Reduced Speed/ Work Zone Warning
- Pedestrian Warning for Transit Vehicles
- Smart Roadside

**MOBILITY APPS**
- Integrated Dynamic Transit Operations (IDTO)
- Intelligent Network Flow Optimization (INFLO)
- Multi-Modal Intelligent Traffic Signal System (M-ISIG)
- Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)
- Enable Advanced Traveler Information System (EnableATIS)
- Freight Advanced Traveler Information System (FRATIS)

**ENVIRONMENT APPS**

**AERIS**
- Dynamic Low Emissions Zone
- Dynamic Eco-Lanes
- Eco-Traveler Information
- Eco-Signal Operations
- Eco-ICM
- Support AFV Operations

**Road Weather**
- Enhanced Maintenance Decision Support System
- Information for Maintenance and Fleet Management Systems
- Variable Speed Limits for Weather-Responsive Traffic Management
- Motorist Advisories and Warnings
- Information for Freight Carriers
- Information and Routing Support for Emergency Responders
Mobility, Weather, and AERIS
Deployment Scenario

Vehicle Positioning GPS

Cellular & other (non-DSRC) Tower

Traffic Management Systems

Traveler Information Systems

Wireless Service Providers Network Operations Center

Data Aggregator (Public or Private)

Information Service Provider (Public or Private)

Wired or wireless Backhaul

Certificate Management Entity

Application Developer

Traveler Information Systems

Winter Maintenance Operations

On-Board Diagnostics

In-vehicle display

DSRC Radio

Cellular & other (non-DSRC) Radio

BSM (1 & 2) Messages

Other Messages (e.g. Probe Data)
Affiliated Connected Vehicle Test Beds

- Real-world, operational test beds that offer the supporting vehicles, infrastructure, and equipment to serve the needs of public and private sector testing and certification activities

- Draft Memorandum of Cooperation (MOC) - create an affiliation of 5.9GHz DSRC infrastructure device makers, operators of V2I installations, and developers of applications that use V2I communication
  - Agreements will help to facilitate the sharing of tools and resources across all facilities to bring about the future deployment of 5.9GHz DSRC and other V2I wireless communication technology
  - MOC commenting period ended recently (Jan 11, 2013); currently assimilating input; lots of interest from stakeholders

- Finalized MOC expected for review shortly (starting 1st quarter of 2013)
To Do:

1. NHTSA Decision on Safety
2. Understand the Market Potential for New Vehicle Based Data Enabled by Connected Vehicles
3. Partner with the Community to Define and Test Applications based on additional SAE J2735 Messages (Probe Data, Environment …)
4. Understand the landscape for Data Aggregation in a Connected Vehicle World
For More Information

www.ITS.DOT.GOV

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