IntelliDrive

Vehicle-to-Vehicle Communications
For Safety

ITS America Annual Meeting
May 3, 2010

Ray Resendes
US Department of Transportation
National Highway Traffic Safety Administration
The Problem!!!

Safety
- 33,963 deaths/year (2009)
- 5,800,000 crashes/year
- Leading cause of death for ages 4 to 34

Mobility
- 4.2 billion hours of travel delay
- $78 billion cost of urban congestion

Environment
- 2.9 billion gallons of wasted fuel
The Vehicle That Doesn’t Crash

DSRC technology for safety is a less expensive and better performing alternative to current technologies.
It’s All About Connectivity

- E-payment Transactions
- Signal Phase and Timing Information
- V2V Safety Messages
- Probe Data
- Infrastructure Communications

“The Network”

- Real Time Network Data
- Situation Relevant Information

Opportunity for Innovation
Evolution of IntelliDrive

Original VII Deployment Model
- DSRC based for all applications
  - Infrastructure intensive using new DSRC technology
  - Vehicle turnover for embedded DSRC technology
  - Start with V2I (for all application types) and evolve into V2V (safety)

US DOT’s Current Perspective on IntelliDrive Deployment
- Non-safety (mobility, environment)
  - Leverage existing data sources & communications; include DSRC as it becomes available
  - Support development of key applications for public agencies using current data sources
- Safety → DSRC
  - Aggressively pursue V2V; leverage vehicle capability for V2I spot safety
  - Can leveraging of nomadic devices & retrofitting accelerate benefits?
  - Infrastructure requirement is still a TBD (security)
Vehicle Safety Communications

- Replace Onboard Sensors
- Dedicated Short Range Communications (DSRC)
  - 5.9 GHz
  - Low Latency
  - ~300m Range
- Positioning
  - GPS
  - Relative Positioning
  - High Accuracy DGPS not required
- No Digital Map Required
Opportunity for Safer Driving

- **Greater situational awareness**
  - Your vehicle can “see” nearby vehicles and knows roadway conditions you can’t see

- **Reduce or even eliminate crashes thru:**
  - Driver Advisories
  - Driver Warnings
  - Vehicle Control

*IntelliDrive has the potential to address 82% of the vehicle crash scenarios involving unimpaired drivers*
## IntelliDrive for Safety Programs

<table>
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<th>Initiative</th>
<th>Objectives</th>
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| **V2V**                             | • Support NHTSA regulatory decision for 2013  
• Could cover NEW cars, trucks, and buses                                                                                              |
| **Safety Pilot**                    | • Ensure technical and institutional viability through real-world deployment testing.  
• Accelerate in-vehicle technology to ensure value to the first V2V deployed vehicles                                                   |
| **Human Factors for IntelliDrive**  | To eliminate distractions related to ITS devices as a contributing factor to crashes.                                                      |
| **Policy**                          | Develop policy options and actionable recommendations for privacy, security, governance and other issues                                  |
| **International Harmonization**     | Develop internationally harmonized standards, particularly around vehicle-based applications                                            |
| **Vehicle-to-Infrastructure**       | Enable active safety applications that assist vehicle operators (including cars, trucks, and buses) and pedestrians in avoiding or mitigating crashes.|
| **Systems Engineering**             | This revised baseline architecture and requirements will serve as the technical foundation for the next generation of IntelliDrive field tests, for initial and ongoing deployments of IntelliDrive, and for continued research as the core technologies and program evolve |
| **MI Testbed**                      | Create a common resource for public and private sector multi-modal testing                                                               |
Vehicle to Vehicle Safety Application Research Plan

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<td>Crash Scenario Frame Work</td>
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<td>Interoperability</td>
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- **Complete CAMP-V SC-A**
  - Update Crash Scenarios
  - Define Initial Performance Requirements

- **IntelliDriveSM System Engineering**
  - **Select Applications**
    - Complete Message and Communication Standards
    - Data Authentication
    - Development Tests
    - Final Standards & Protocols
    - Regulator or NCAP Decision
  - Security & Privacy (Certificate Authority)
  - Define Performance Measures
  - Develop Objective Tests
  - Conduct Objective Tests
  - Safety Benefits Estimate
  - Field Trials
  - Performance Requirements

- **IntelliDriveSM System Engineering**
  - Develop & Build Prototype Safety Application Vehicles
  - DVI Effectiveness – Multiple Warnings
  - Driver Workload Issues
  - Driver Acceptance

- **IntelliDriveSM Principles**
  - Retrofit & Aftermarket Req’ts
  - Security & Privacy Policy (V2V)
  - 5.9 Enforcement
  - Business Models
  - Governance (V2V)

- **Update Crash Scenarios**
  - Define Initial Performance Reqs and Measures
  - Develop and Conduct Objective Tests
  - Driver Workload Issues and Acceptance
  - Field Tests

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## V2V Program

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<tr>
<td>1 – Crash Scenario</td>
<td>Develop a comprehensive Pre-Crash Scenario Framework, and countermeasure concept profiles for both light vehicles and heavy trucks.</td>
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<tr>
<td>2 – Interoperability</td>
<td>Ensure that V2V safety systems can successfully function across equipped vehicles regardless of make/model.</td>
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<td>3 – Benefits Assessment</td>
<td>Benefits assessments for V2V safety applications</td>
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<tr>
<td>4 – Application Development</td>
<td>Develop applications for benefits assessment</td>
</tr>
<tr>
<td>5 – Driver Issues</td>
<td>Develop a framework to assess the impact of driver issues on the effectiveness of DVI's used with V2V safety applications.</td>
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<tr>
<td>6 – Policy</td>
<td>Through coordination of the technical and policy aspects of V2V this track will result in a set of policy recommendation to support V2V deployment.</td>
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<tr>
<td>7 -Commercial Vehicles</td>
<td>Identify and coordinate the commercial vehicle component of V2V safety applications.</td>
</tr>
<tr>
<td>8 – Transit Vehicles</td>
<td>Identify and coordinate the transit vehicle component of V2V safety applications.</td>
</tr>
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Technical and Policy Interactions

(For Example: Security vs Privacy Trade-offs)

- Policy trade-offs will require senior level decisions.
Outstanding Technical Issues

- Addressed under current CAMP Agreement
- Independent technical peer review
- Safety Pilot provides real-world implementation

- Penetration vs Effectiveness
- Driver Acceptance
- Data Security
- Positioning
- Scalability
- Channel Switching
Outstanding Policy Issues

• Critical V2V Policy Issues Being Defined
• V2V Policy White Paper/Roadmaps Being Developed
• Internal and External Stakeholder Engagement Being Defined

• How will tradeoffs between security, privacy and functionality be managed?

• Operations
  ▪ Who will monitor for misbehavior?
  ▪ Who will operate the Security Certificate Authority?

• Compliance & Enforcement
  ▪ Who will enforce DSRC standards?
  ▪ How will the rules of operation be developed and enforced?
  ▪ How and who will certify DSRC devices?
Safety Pilot

Goals:
- Support the 2013 Regulatory V2V Decision with Field Data
- Public Awareness & Acceptance

Primary Objectives
• Demonstrate V2V real world implementation
  • Multiple vehicle types (cars, trucks, buses, rail, etc)
  • Obtain substantial empirical data
• Assess driver acceptance of vehicle based safety systems
• Explore opportunities for accelerating safety benefits through aftermarket devices and retrofit systems

Secondary Objectives
• Enable vehicle-infrastructure (V2I) safety applications
• Leverage data for non-safety applications such as mobility, environment, and weather
Safety Pilot Activities

• Driver Clinics
  • Driver acceptance data from light vehicle driver clinics at various locations
    • Explore similar opportunities for other vehicle types
    • Performance testing in multiple geographic environments using small numbers of light vehicles and nomadic devices at same locations

• Model Deployment
  • Critical Mass/Exposure testing → large number of vehicles and devices creating a “highly saturated” operating environment
  • Mixture of integrated safety systems with nomadic devices
  • Cars, trucks, buses, fleets, rail crossings
  • Lots of vehicles, limited infrastructure
## Safety Pilot Roadmap

### CY 2010
- **Q1**: Initial Integrated Safety System Light Vehicle Builds
- **Q2**: Light Vehicle Driver Clinics & Performance Testing
- **Q3**: Transit Vehicle Roadeo
- **Q4**: Heavy Vehicle

### CY 2011
- **Q1**: Aftermarket Device Development
- **Q2**: Device Updates
- **Q3**: Vehicle Updates
- **Q4**: Model Deployment Ramp-up and Preliminary Testing

### CY 2012
- **Q1**: Model Deployment Full Scale Testing
- **Q2**: Model Deployment Assessment
- **Q3**: V2V Benefits Assessment
- **Q4**: V2V Regulatory Decision Point

### CY 2013
- **Q1**: Input to Industry standards based upon test results
- **Q2**: V2V Benefits Assessment
- **Q3**: V2V Regulatory Decision Point
- **Q4**: V2V Regulatory Decision Point

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**Evaluation**

- **Independent Evaluation of Testing Activities**
For More Information…..

- www.intellidrive.org
- www.nhtsa.gov
- www.regulations.gov
  Docket No. NHTSA-2009-0108