TODAY’S AGENDA

- Gene McHale
  Team Leader, FHWA Office of Operations R&D
  - Connected Vehicle Pilot Deployment Program Overview
  - Open Data

- Randy Butler
  Manager, FHWA Freight Operations and Technology
  - Open Source
  - Performance Measurement

- Stakeholder Q&A
Connected Vehicle Pilot Deployment Program Overview
PROGRAM GOALS

Spur Early CV Tech Deployment

Wirelessly Connected Vehicles

Mobile Devices

Infrastructure

Measure Deployment Benefits

Safety

Mobility

Environment

Resolve Deployment Issues

Technical

Institutional

Financial
ORGANIZING PRINCIPLES AND REQUIREMENTS

- Organizing Principles
  - Problem-Driven
  - Multiple Pilot Sites
  - Large-Scale and Multi-Modal
  - Multiple Applications Deployed Together

- Deployment Requirements
  - Multiple Forms of Communication Technologies
  - Data Capture and Sharing
  - Quantifiable Performance Measures
  - Security and Credentialing Management System
## CONNECTED VEHICLE APPLICATIONS

### V2I Safety
- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

### V2V Safety
- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

### Agency Data
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

### Environment
- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

### Road Weather
- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

### Mobility
- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

### Smart Roadside
- Wireless Inspection
- Smart Truck Parking
CV PILOTS DEPLOYMENT SCHEDULE AND RESOURCES

- Proposed CV Pilots Deployment Schedule

<table>
<thead>
<tr>
<th>Schedule Item</th>
<th>Date</th>
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<tbody>
<tr>
<td>Regional Pre-Deployment Workshop/Webinar Series</td>
<td>Summer-Fall 2014</td>
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<tr>
<td>Solicitation for Wave 1 Pilot Deployment Concepts</td>
<td>Early 2015</td>
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<tr>
<td>Wave 1 Pilot Deployments Award(s)</td>
<td>September 2015</td>
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<tr>
<td>Concept Development Phase (6-9 months)</td>
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<tr>
<td>Design/Build/Test Phase (10-14 months)</td>
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<tr>
<td>Operate and Maintain Phase (18 months)</td>
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<tr>
<td>Solicitation for Wave 2 Pilot Deployment Concepts</td>
<td>Early 2017</td>
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<tr>
<td>Wave 2 Pilot Deployments Award(s)</td>
<td>September 2017</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Pilot Deployments Complete</td>
<td>September 2020</td>
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- Resources
  - ITS JPO Website: [http://www.its.dot.gov/](http://www.its.dot.gov/)
  - CV Pilots Program Website: [http://www.its.dot.gov/pilots](http://www.its.dot.gov/pilots)
CV PILOTS
WEBSITE

http://www.its.dot.gov/pilots

Connected Vehicles
CV Pilots Deployment Project

Latest News & Updates

- Sample Deployment concept audio recordings for District 13 Operations is now available (3/23/14)
- Sample Deployment concept audio recordings for Greypool County is now available (9/22/14)
- Deployment concept audio recordings for Downtown Sunnyside and H.W. Hallack Expressway are now available (9/18/14)
- CV Pilots FAQs (Updated September 16, 2014)
- The USDOT Connected Vehicles Pilot Deployment Program Webinar Series Part 2: Communications and Role of DSRC is open for registration
- The presentation material of the USDOT Connected Vehicles Pilot Deployment Program Webinar Series Part 1 is available now
- The Descriptions of the Connected Vehicle Applications are available now
- Summary of Responses to the Connected Vehicle Pilot Deployment Program’s Request for Information (RFI)

About the CV Pilots Deployment Project

The U.S. DOT (DOT) connected vehicle research program is a multimodal initiative that aims to enable safe, interoperable networked wireless communications among vehicles, infrastructure, and personal communications devices. Connected vehicle research is sponsored by the DOT and others to leverage the potentially transformative capabilities of wireless technology to make surface transportation safer, smarter, and greener. Research has resulted in a considerable body of work supporting pilot deployments, including concepts of operations and prototyping for more than two dozen applications. Concurrent Federal research efforts developed critical cross-cutting technologies and other enabling capabilities required to integrate and deploy applications.

Based on the successful results of the connected vehicle research program, and the recent decision by NHTSA to pursue vehicles to vehicle communications safety technology for light vehicles, a robust connected vehicle pilots program is envisioned as a mechanism to spur the implementation of connected vehicle technology. These pilots will serve as initial implementations of connected vehicle
Open Data
OPEN DATA OVERVIEW

- **Definition**
  - Open data is data that can be freely used, reused and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike. (http://opendatahandbook.org/)

- **Characteristics of Open Data**
  - Reusable by third parties with few or no restrictions
  - Available at little or no cost
  - Discoverable (easy to find)
  - Usable (documented, in standard formats)

- **Open Data Concerns**
  - Protecting privacy
  - Protecting data of individual entities (e.g. Commercial carriers)

- **Commons License Open Data License**
  - Free to: Share, Create, and Adapt data
  - Long as you: Attribute, Share-Alike, Keep open
OPEN DATA IN PILOT DEPLOYMENT

- CV Pilot program intends to make all \textit{data open}. Why?
  - Pilot Deployments are intended to INFORM and GUIDE broader mainstream deployment of Connected Vehicle technologies, through….

- Data Preservation and Sharing
  - Collect, organize and archive pilot deployment data for research
  - Archive or make available as real-time feed in Research Data Exchange (RDE)
  - Share experience with all stakeholders considering their own future deployments

- Supporting Concurrent or Follow-On Research Efforts, such as:
  - How can the expected \textit{large volume} of data from CV applications be efficiently managed?
  - How can the \textit{variety of data} and new data sources in a CV environment enable new applications and services?
  - How can data \textit{quality control} be implemented in a real-time CV environment?
CV DATA ENABLES CV APPLICATIONS

Real-time Data Capture and Management

- Vehicle Status Data
- Weather Data
- Truck Data
- Mobile Devices

Connected Vehicle 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

Data Environments

U.S. Department of Transportation
RESEARCH DATA EXCHANGE (RDE)

- Promotes sharing of archived and real-time connected vehicle data collected in USDOT-sponsored research efforts and field tests
- 2 TB of well-organized and documented data
- Drawn from a dozen geographic locations across the country
- Multi-source data (traditional sensor plus probe and connected vehicle data)
- Search and download functions
- RDE Release 2.0 is now available
- Detailed data submission guidelines by Jan 2015

www.its-rde.net
Open Source
OPEN SOURCE OVERVIEW

- **Definition**
  - Software that gives users the right to run, copy, distribute, study, change, and improve it as they see it, without having to ask permission from or make fiscal payments to any external group or person. (http://opensource.org/osd)

- **Requirements** in the Pilot Deployment
  - New software developed using Federal funding must be open source.
  - Existing software brought to the project and not modified need not be made open source
  - Modify existing proprietary software or combined Federal / private funding of new software development will be a case by case basis
    - emphasis will be on making the changes or alterations open source, where possible
  - The USDOT encourages the use of “permissive” open source licenses, such as the Apache license
OPEN SOURCE APPLICATION DEVELOPMENT PORTAL

www.itsforge.net

- Portal for sharing documentation and source code from USDOT-sponsored application prototyping efforts
- By end of 2014, will be populated with materials describing 10+ connected vehicle applications
- Contributed code must meet documentation guidelines
- Search and download functions
- Release 1 is now available to the public
**USDOT Mobility Program – OSADP Scope**

- **Purpose:** Develop, operate, and maintain an open source portal that will enable multiple stakeholders to collaborate on application development.

- **Coordination:** Application bundles require concurrent, collaborative development.
  - For example, in the MMITSS bundle, pedestrian signal phases in the PED-SIG application must be coordinated with applications providing priority or pre-emption services.
  - This coordination extends to both DMA-funded application development and research conducted at UTCs and other organizations.

- **Transparency:** the Open Source Portal provides the mechanism to ensure application development is transparent and broadly available.
CURRENT OSADP ARCHITECTURE

OSADP

Public Portal
• High-level project information
• Invitation to join community

Community Portal
• Access released source code repository
• Discussion
• Idea exchange
• Feedback
• Comments
• Suggestions
• May become a Github user and join OSADP project

GITHUB

Portal Manager

Development Subsystem

OSADP Private Repositories

Collaborative App Development Environment

Portal Manager

GitHub Users

Registered Users

Visitors

Github Authorized Collaborators

Registered Users

• Install / Use

• Access released source code repository
• Discussion
• Idea exchange
• Feedback
• Comments
• Suggestions
• May become a Github user and join OSADP project

Install / Use

• High-level project information
• Invitation to join community

Registered Users

Visitors
OPEN SOURCE IN THE OSADP

- Case 1: New Code, Acceptable Open Source License
- Case 2: New Code, Copyright Transferred to USDOT
- Case 3: New or Modified Code, Signed Contributor License Agreement

- Cases 2&3: The code, if accepted, will be released by USDOT under the Apache 2.0 License
**Apache 2.0 Open Source License: Overview**

**Can**
- Download and use for free
- Incorporate software in proprietary package you create
- Make changes without having to resubmit as open source

**Cannot**
- Redistribute without proper attribution
  - Use any Trademarks or Logos that may State that the Organization Endorses your Distribution
  - Restrict use of the software

**Must**
- Include License in any redistribution that includes the software
- Document which files where modified in any New Distribution
Performance Measurement
PILots deployment must address a critical problem

- A problem-driven deployment process
- Must have measurable impacts

Pilots deployment must have performance-driven capability for self-assessment

- Quantitative performance measures supporting continuous improvement
- Support an independent evaluation effort

Assessment frequency depending on the types of measurements

- Hourly, daily, weekly, monthly
- Over a long term and continuity
FOLLOWING THE PILOT DEPLOYMENT PROCESS

- **Pilot Deployment Concept Development Process**
  - Identify Local Needs
  - Set Performance Goals
  - Select CV Applications That Work Together Meet Those Goals

- **USDOT Sample Pilot Concepts from Hypothetical Locations**
  - Hypothetical, but realistic examples of localities applying the pilot deployment concept development process

- **Using I-876 Productivity Corridor as an example**
  - Problem-driven pilot deployment
  - Self-assessment capability “built-into” operational system
I-876 PRODUCTIVITY CORRIDOR
~ IDENTIFY KEY TRANSPORTATION CHALLENGES ~

- **Freight Productivity**
  - Heavy congested freeways interferes with timely and reliable freight movement and hinders economic development
  - Underutilized freight facilities, infrastructure, and mobile assets
  - Frequent empty moves within the corridor create non-optimal utilization of assets
  - Port, airport and inter-modal access subject to surge demand and long waits

- **Truck Safety**
  - Truck-vehicle conflicts in hilly merge/weave sections near interchanges
  - Truck-involved crashes caused by lane changing and blind spots
### Applications Selected

- **Improve Freight Productivity**
  - Freight Advanced Traveler Information System (FRATIS)
  - Drayage Optimization (DRG-OPT)
  - Freight Signal Priority (FSP)

- **Improve Truck Safety**
  - Smart Truck Parking
  - Curve Speed Warning (CSW)
  - Do Not Pass Warning (DNPW) /Lane Change Warning (LCW)
I-876 PRODUCTIVITY CORRIDOR
~ SELF ASSESSMENT EXAMPLES ~

Truck Safety Apps
- Smart Truck Parking
- Curve Speed Warning
- Do Not Pass Warning /Lane Change Warning

Safety Related PMs
- Number of truck-vehicle conflicts
- Number of truck-involved crashes
- Number of unsafely parked trucks in rest areas/"hotspots"

Possible Approaches
- Video detection in safety hotspot to count conflicts/crashes
- Count trucks unsafely parked in rest areas each night (hourly)
### Truck Mobility Apps
- Freight Advanced Traveler Information System
- Drayage Optimization
- Freight Signal Priority

### Mobility Related PMs
- Number of empty/wasted trips
- Freight travel times
- Truck wait times to intermodal facilities

### Possible Approaches
- Partner with drayage companies to measure fleet travel time/efficiency
- Install Bluetooth readers and roadside units on approaches to intermodal facilities
WRAP UP ON PERFORMANCE MEASUREMENTS

- Focus on a few key measures
- Performance-measurement should be “built in” to the pilot deployment
- Supports continuous improvement/dynamic management
- Measure actual improvements relative to deployment goals
Stakeholder Q&A