Wyoming Pilot Acquisition and Installation Experiences

Kate Hartman, Vince Garcia, Tony English, Shane Zumpf

ITS Joint Program Office
Purpose of this Webinar

- Provide an overview of the approach for identifying the type and number of devices, equipment, and software-based capabilities that needed to be acquired
- Share experiences of engaging with vendors and getting the devices in hand and installed while adhering to a stringent installation schedule
- Identify technical and other barriers and how they are being overcome

Webinar Content

- Connected Vehicle Pilot Deployment Program Overview
- WYDOT Pilot Acquisition and Installation Experiences
- Stakeholder Q&A

Webinar Protocol

- Please mute your phone during the entire webinar
- You are welcome to ask questions via chat box at the Q&A Section
- The webinar recording and the presentation material will be posted on the CV Pilots website
Program Goals

- Participate in upcoming Webinars/Conference Presentations from the three Pilot Sites (see website for exact dates and times)

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<tr>
<td>Device Acquisition and Installation</td>
<td>ITE Annual Meeting</td>
<td>Operational Readiness</td>
<td>TRB</td>
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Stay Connected

- Visit Program Website for Updates: http://www.its.dot.gov/pilots
- Contact: Kate Hartman, Program Manager, Kate.Hartman@dot.gov
WYDOT CV Pilot Deployment Overview

Vince Garcia
Knighting’s I-80 Corridor

Heavy Freight Traffic
- Major E/W freight corridor
- Freight = over half of annual traffic

Severe Weather Conditions
- Roadway elevation
- Heavy winds, heavy snow and fog
- Severe blowing snow and low visibility

Adverse Impacts on Trucks
- Higher than normal incident rates
- Multi-vehicle crashes
- Fatalities

Source: WYDOT (Dec 17, 2015)
Why this project is important

700 incidents involving commercial vehicles occurred on I-80 since project kick-off
Forward Thinking

- Standards-Driven
- Integration with Third-Party Intermediaries
- Integration with Satellite Delivery of TIMs
- Close coordination with other CV sites

The Future
NEXT EXIT

U.S. Department of Transportation
Freight-focused

• ~150-200 are large trucks
• ~100 are small/medium trucks

CV Trucks

• Trucking Companies of various sizes
  • Double D Distribution
  • Dooley Oil
  • Trihydro
  • Others...

Fleet Partners

• CVOP Users (800 firms)
• Wyoming Trucking Association
• Third Party Intermediaries

Freight Partners
Supports I-80 Traveler Information

Supports VSL and other traffic mgmt. strategies

Integrated with TMC Management Systems

WYDOT’s VSL, 511 and other services will rely on CV data
Integrated with WYDOT Fleets

Environmental Probe Data Collection

Leverage existing technology

~100 DSRC-enabled snow plows and highway patrol vehicles

WYDOT’s use of its own fleets in the CV pilot will allow for continued operations post pilot
Starting from September 2018, these deployments are scheduled to enter an operational phase.
WYDOT CV Pilot System Overview

Tony English
System Overview - Vehicle System

All vehicles that are part of the vehicle system will have:

- Ability to share information via DSRC with connected devices (vehicles and RSUs)
- Ability to broadcast Basic Safety Message
- Ability to receive Traveler Information Messages (TIM)
- Human-Machine Interface (HMI) to communicate alerts and advisories to driver

Vehicle Sub-Systems
1. WYDOT Fleets
2. Integrated Trucks
3. Retrofit Vehicles
4. Highway Patrol

On-board Vehicle Technologies
- OBU with DSRC and Satellite Receiver
- Human Machine Interface
- CAN Bus Integration
- Environmental Sensors
All vehicles that are part of the Vehicle System will have

- Ability to share and receive information via DSRC from other connected devices (vehicles and RSUs)
- Ability to broadcast Basic Safety Message
- Ability to receive Traveler Information Messages (TIM)
- A human-machine interface that allows alerts and advisories to be communicated with the driver.
# Acquired Equipment

<table>
<thead>
<tr>
<th>Devices</th>
<th>TMC Equipment</th>
<th>Installation Equipment</th>
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<tbody>
<tr>
<td>• OBUs ~ 400</td>
<td>• Server, storage array, switch</td>
<td>• Test laptop</td>
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<tr>
<td>• RSUs – 78 units</td>
<td>• Hardware Security Module</td>
<td>• Cabling Tools</td>
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<td>• Wire</td>
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<td></td>
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<td>• Soldering equipment</td>
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<td>• Sniffer</td>
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WYDOT CV Pilot Acquisition Experiences

Tony English
Acquisition Approach

- WYDOT built system around a rural deployment
  - Could not provide full coverage via DSRC for RSU to OBU TIM messaging
  - Chose Sirius XM as partner to provide coverage for I-80 corridor (and the rest of WY for future expansion)
  - DSRC RSUs were used at 75 critical points providing 300-1000 meter radius coverage each
    a. Selected locations around a mile before vehicles would enter historically troublesome areas (blow overs, fog, snow, ice, etc.)
  - Selected RSU and OBU vendors that could provide custom applications and Sirius XM communication in addition to DSRC
Selection Criteria

- TMC Hardware Criteria
  - Analyzed Cloud vs onsite hardware
    - Wyoming has a Cloud first philosophy for data center implementations (through Enterprise Technology Services, ETS)
    - Costs ($) over 3 years were similar (labor, network, software, hardware)
    - Had concerns with network resilience to Cloud providers, IPv6, and performance concerns with existing TMC operations (WTI, Oracle, RWIS)
Selection Criteria

- TMC Hardware Criteria
  - Chose TMC hardware over Cloud
  - Chose Dell to provide 2 virtualization rack servers and redundant SAN
  - Chose Hyper-V (2016 core) for virtualization platform
  - Chose 10 gig ethernet for both SAN and LAN network (but each isolated)
  - Built IPv6 and IPv4 network for LAN, WAN to RSU's and WAN to Internet (all in native dual stack, not tunneled)
Selection Criteria

- OBU/RSU Vendor Criteria
  - DSRC experience
  - Sirius XM integration
  - SCMS experience
  - Custom application development willingness
  - $ 

- Chose Lear for all RSUs and 375 OBUs 
- Chose Sirius XM for 25 OBUs
WYDOT CV Pilot Installation Experiences

Shane Zumpf
**Installation Approach**

### TMC Hardware – Server/Storage Array/Switch/HSM

**Connected Vehicle – 10GBase-T Data Network**
- (default) VLAN 1 (10GBase-T)
- ISCSI_FAULT_DOMAIN_100 (10GBase-T)
- ISCSI_FAULT_DOMAIN_200 (10GBase-T)

**Connected Vehicle Management Network**
- (default) VLAN 1 (10GBase-T)
- ISCSI_FAULT_DOMAIN_100 (10GBase-T)
- ISCSI_FAULT_DOMAIN_200 (10GBase-T)
- Management Ports

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**Wydot TMC**
- Oracle Server
- Clients needing to access Pikalert Server
- Clients needing to access ODE server

**R730_1 Intel 540 DP (slot 2/2)**
- to Te1/0/8
- MAC: AD12:4C0:12B4 – IP: 10.145.9.125

**R730_1 Intel 540 DP (slot 3/2)**
- to Te1/0/6
- MAC: AD12:4C0:12B5 – IP: 10.145.9.150

**R730_2 Intel 540 DP (slot 2/2)**
- to Te1/0/5
- MAC: AD12:4C0:12B6 – IP: 10.145.9.146

**R730_2 Intel 540 DP (slot 3/2)**
- to Te1/0/7
- MAC: AD12:4C0:12B7 – IP: 10.145.9.135

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**Dell R730_1 iDRAC**
- MAC: DAED.913.A334
- IP: 10.145.9.106

**Dell R730_1 iDRAC**
- MAC: DAED.913.9134
- IP: 10.145.9.242

**Dell R730_2 iDRAC**
- MAC: DAED.913.92F8
- IP: 10.145.9.142

**SAN Controller 1, Mgmt.**
- IP: 10.145.9.241

**SAN Controller 2, Mgmt.**
- IP: 10.145.9.239 (241)

**Dell N4032 OOB port**
- IP: 10.145.9.240

**Virtual Machines**
- Hyper-V Mgmt.
- Desktop Mgmt.
- Web Mgmt.

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**Network with Servers Hosting**
- SNMP trap receiver
- Dell Storage Manager client
- Dell Storage Data Collector
- Hyper-V Manager

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**Te1/0/14 - Uplink**

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**TBD switch**

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**iDRAC**
- 1 2 3 4
- ST
- 2
- 1
- 2
- 1
- 3
- 750W
- 5
- 4 6
- 1
- 1
- 3
- 750W
- 5
- 4 6
- 1
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- 3
- 750W
Installation Approach

- OBU Installs
Basic Install - Antenna Placement
Basic Install - HMI Placement
Installation Approach

- Rudimentary installs
  - Allowed for quick basic testing
- Simple installations began to find problems
  - Connections in OBU units
  - Antenna issues
  - HMI placement issues
  - Interference with other devices (Weather Cloud and HMI)
Permanent Installations

- Installations on Vehicles for the Duration of the Pilot
- Trihydro and WYDOT Vehicles
- Each responsible for installing in own vehicles
- Trihydro – contracted with local audio installer for installations
Snow plow installations

- Plows had unique problems
- Required more configuration
  - Antenna placement
  - Larger vehicle
  - HMI/RCRS App interaction
- Not all plows have metal roof (Antenna base is magnetic)
- Plow cab not the high point for the vehicle (Antenna has no clear line of sight when mounted directly to the roof)
Snow plow installations
Snow plow installations
Snow plow installations
Snow plow installations

- Roof installs in sheet metal ran into problems
- Future installs to be placed in roof ribs for plows
Kit being created for each partner for installation and testing
- Kits include laptop for testing OBU after installation
- Kits include installation steps/guidelines
- Partners will need to customize installations for vehicles that are unique

Software created to help enter antenna placement/configuration
Installation Approach

- RSU Installs
RSU Installs

- Install Locations next to existing infrastructure
  - WYDOT was able to install
  - 48 locations currently deployed (of 75)
  - [https://wydotcvp.wyorado.info/CVM/](https://wydotcvp.wyorado.info/CVM/) (live RSU map)
- Locations with no infrastructure were contracted out to local construction contractors (30 units)
RSU Install Lessons Learned

- Some hardware issues within RSUs found/resolved by vendor
- Software issues required some RSUs to be taken down/sent back to vendor
- IP v4/IP v6 connectivity required a lot of effort to resolve
Please keep your phone muted

Please use chat box to ask questions

Questions will be answered in the order in which they were received
Join us for the Ready to Design, Build, and Test Operational Systems Series

- Discover more about the CV Pilot Sites
- Learn the Essential Steps to CV Deployment
- Engage in Technical Discussion

Visit the Pilot Site Websites for more Information:

- NYCDOT Pilot: https://www.cvp.nyc/
- Tampa (THEA): https://www.tampacvpilot.com/
- Wyoming DOT: https://wydotcvp.wyroad.info/

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