



# CONNECTED VEHICLE PILOT Deployment Program



## Wyoming Pilot Acquisition and Installation Experiences



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ITS Joint Program Office



# TODAY'S AGENDA



- 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





# CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

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

## PILOT SITES



WYDOT



NYCDOT



Tampa (THEA)

STAY CONNECTED

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

July 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019
◆ ◆ ◆		●		◆ ◆ ◆		●
Device Acquisition and Installation		ITE Annual Meeting		Operational Readiness		TRB

◆ Public Webinars      ● Conference Presentations

- Visit Program Website for Updates: <http://www.its.dot.gov/pilots>
- Contact: Kate Hartman, Program Manager, [Kate.Hartman@dot.gov](mailto:Kate.Hartman@dot.gov)





# WYDOT CV Pilot Deployment Overview

Vince Garcia

# Wyoming's I-80 Corridor



## Heavy Freight Traffic

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



Source: WYDOT (Dec 17, 2015)

## Severe Weather Conditions

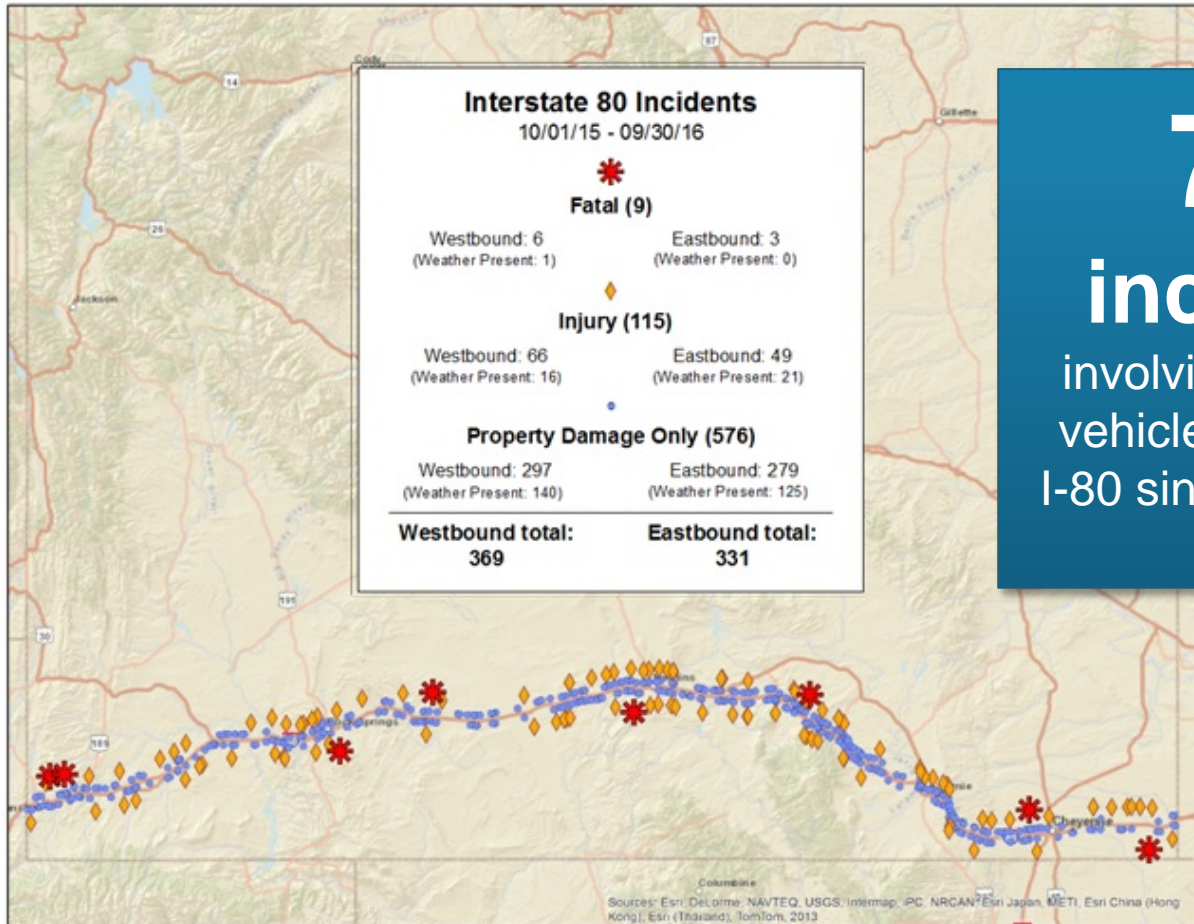
- Roadway elevation
- Heavy winds, heavy snow and fog
- Severe blowing snow and low visibility

## Adverse Impacts on Trucks

- **Higher than normal incident rates**
- **Multi-vehicle crashes**
- **Fatalities**

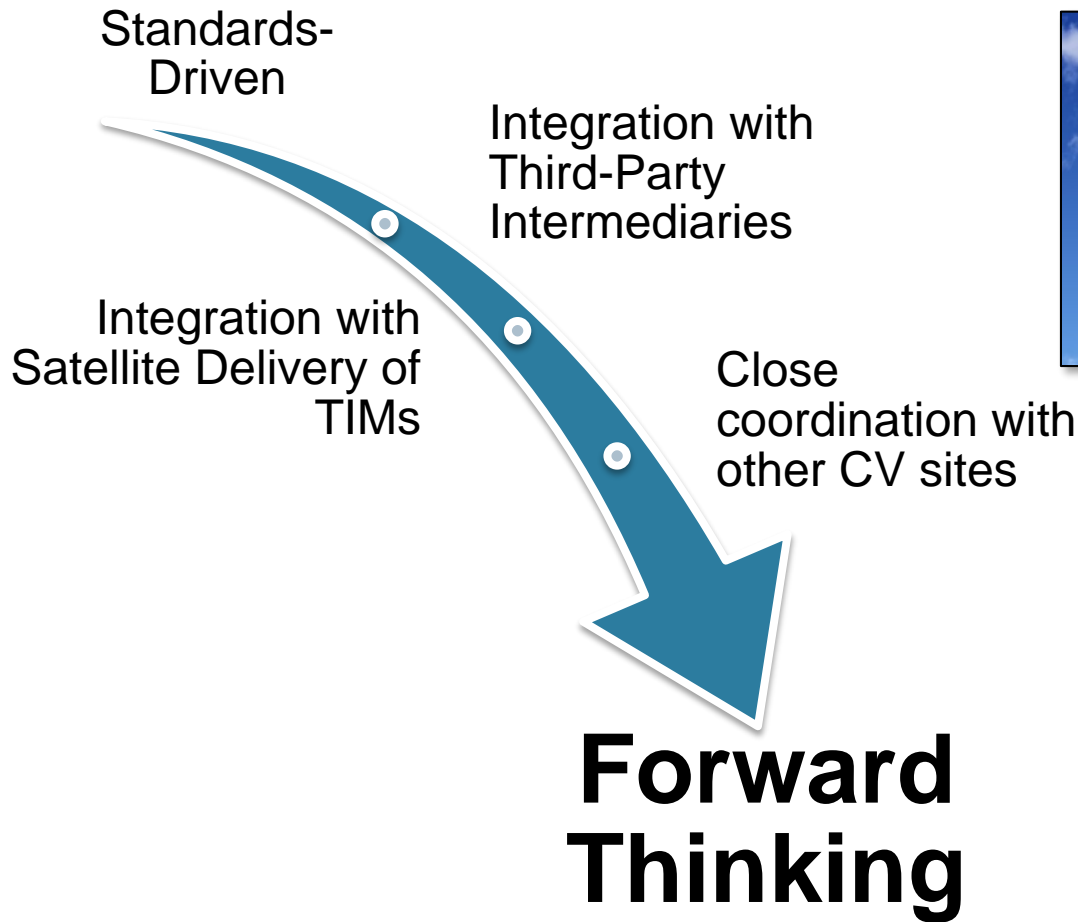


# Why this project is important



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

# Forward Thinking



# Freight-focused



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

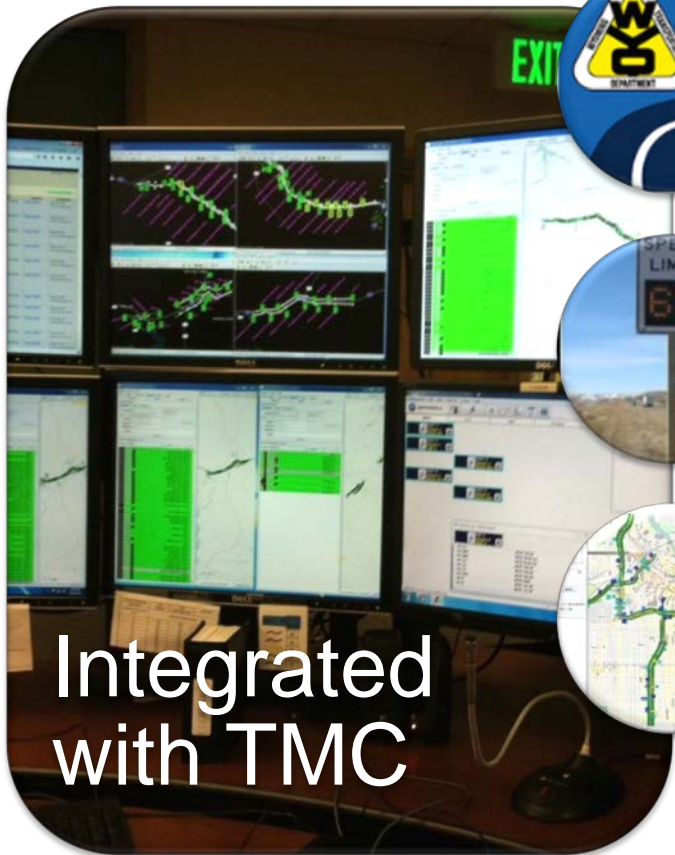
Freight Partners







# Integrated with the TMC



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



Integrated  
with WYDOT  
Fleets



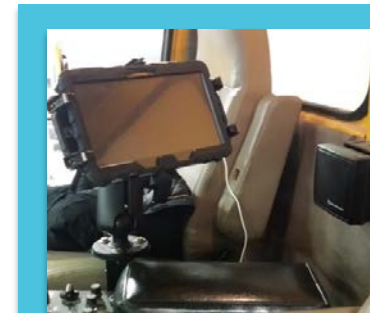
Environmental Probe  
Data Collection



Leverage existing technology



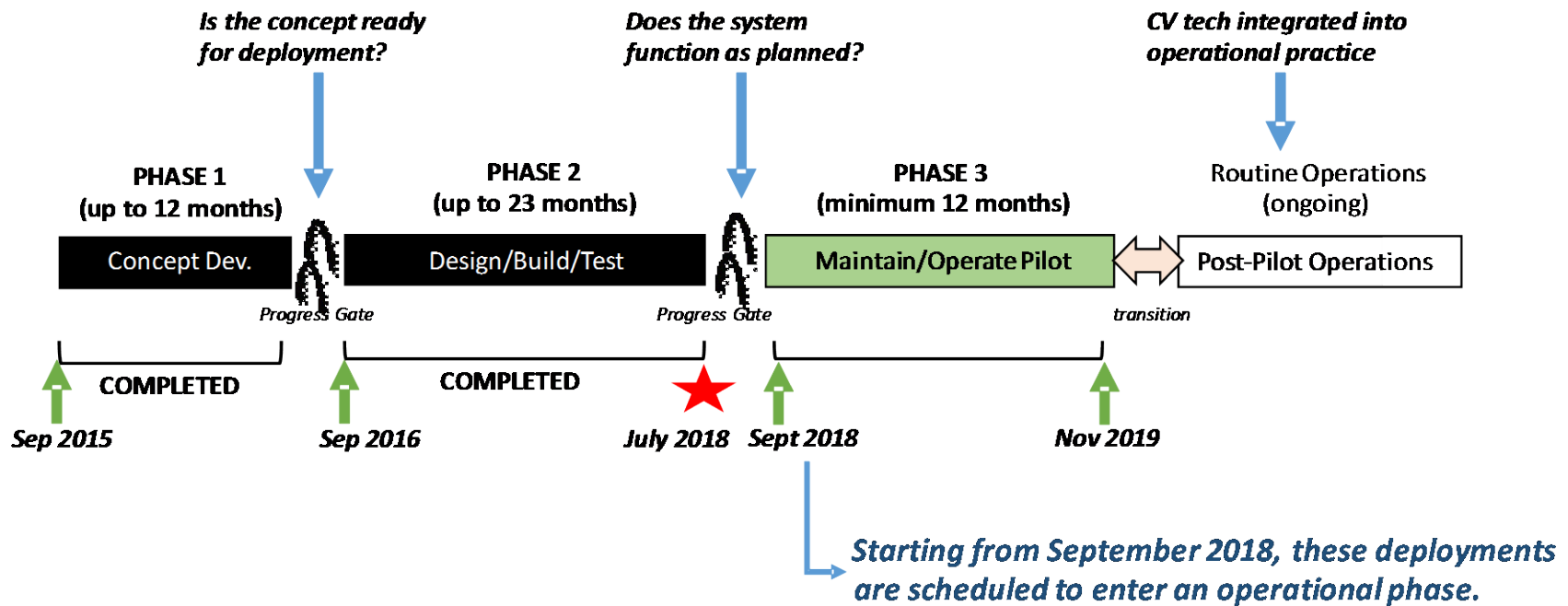
~100 DSRC-enabled snow  
plows and highway patrol  
vehicles



WYDOT's use of  
its own fleets in the  
CV pilot will allow  
for continued  
operations post  
pilot



# DEPLOYMENT SCHEDULE





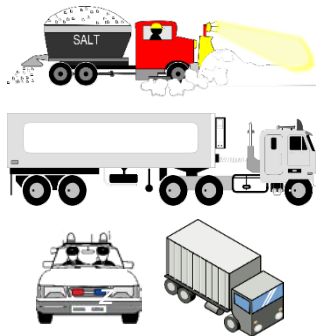
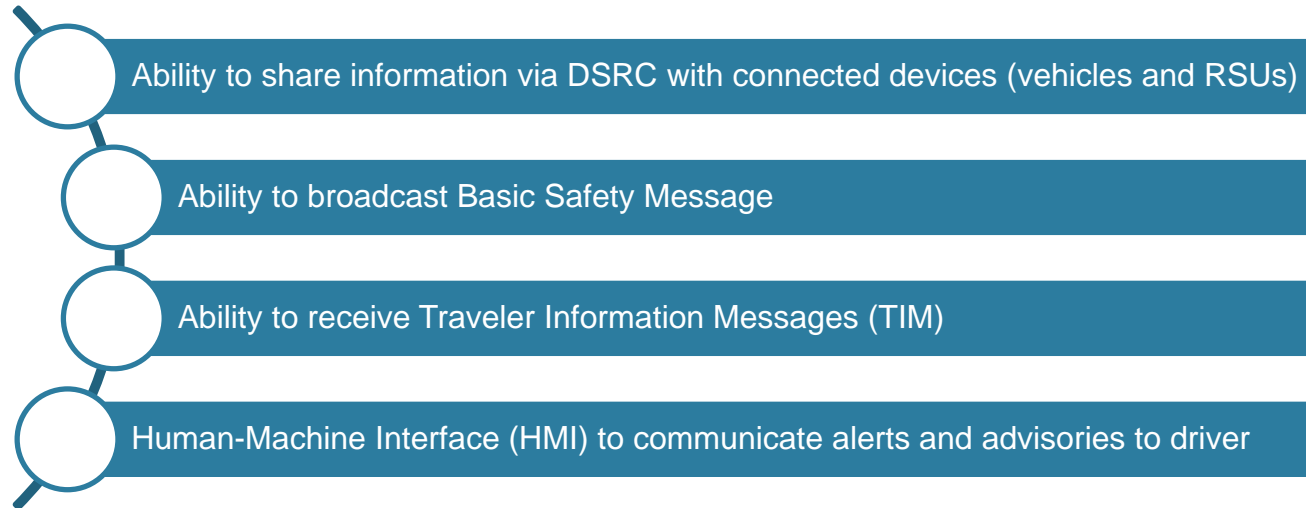
# WYDOT CV Pilot System Overview

Tony English

# System Overview – Vehicle System



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



## Vehicle Sub-Systems

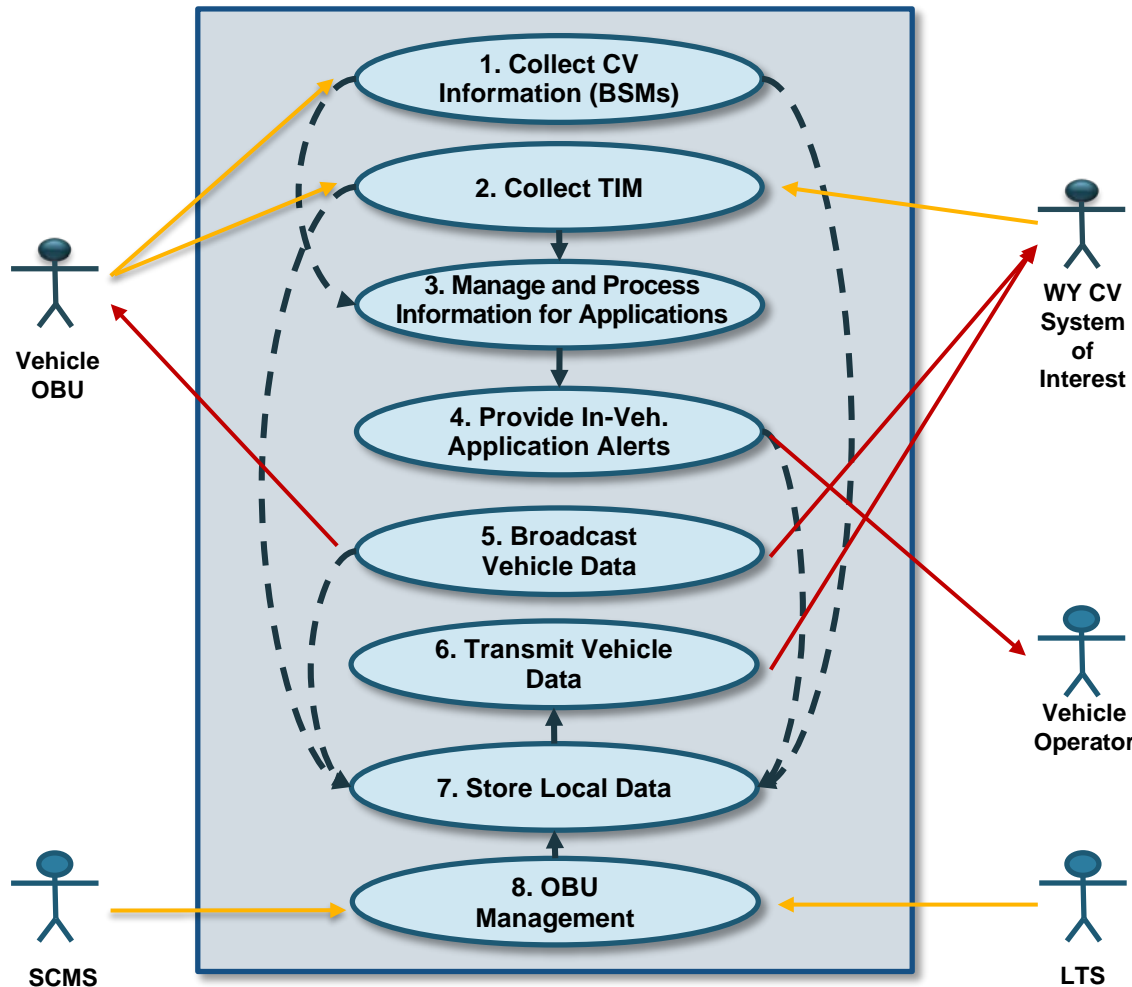
1. WYDOT Fleets
2. Integrated Trucks
3. Retrofit Vehicles
4. Highway Patrol

## On-board Vehicle Technologies

- OBU with DSRC and Satellite Receiver
- Human Machine Interface
- CAN Bus Integration
- Environmental Sensors



# System Overview – Vehicle System



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



## Devices

- OBUs ~ 400
- RSUs – 78 units

## TMC Equipment

- Server, storage array, switch
- Hardware Security Module

## Installation Equipment

- Test laptop
- Cabling Tools
- Wire
- Soldering equipment
- Sniffer





# 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
    - <sup>a</sup> 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
    - <sup>a</sup> Wyoming has a Cloud first philosophy for data center implementations (through Enterprise Technology Services, ETS)
    - <sup>a</sup> Costs (\$) over 3 years were similar (labor, network, software, hardware)
    - <sup>a</sup> Had concerns with network resilience to Cloud providers, IPv6, and performance concerns with existing TMC operations (WTI, Oracle, RWIS)

# Selection Criteria



- TMC Hardware Criteria
  - <sup>a</sup> Chose TMC hardware over Cloud
  - <sup>a</sup> Chose Dell to provide 2 virtualization rack servers and redundant SAN
  - <sup>a</sup> Chose Hyper-V (2016 core) for virtualization platform
  - <sup>a</sup> Chose 10 gig ethernet for both SAN and LAN network (but each isolated)
  - <sup>a</sup> 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

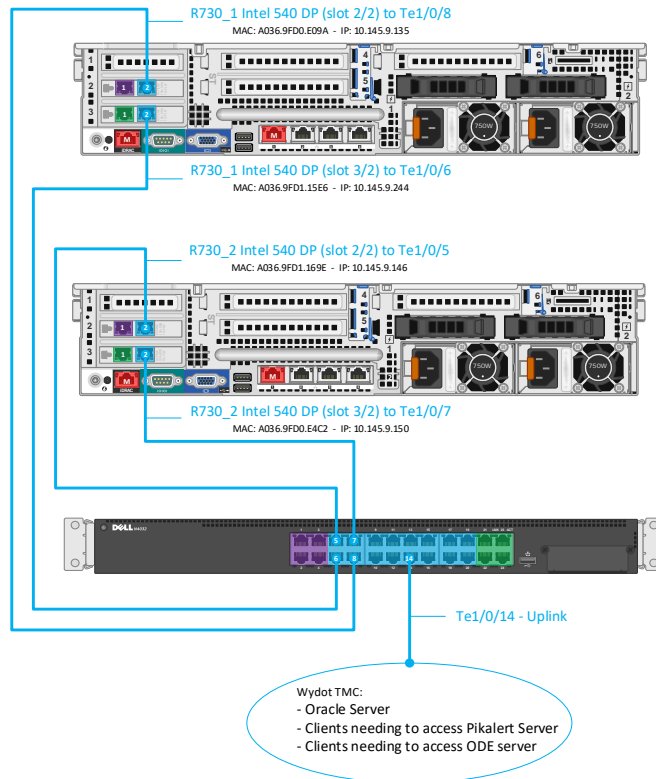


# Installation Approach

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

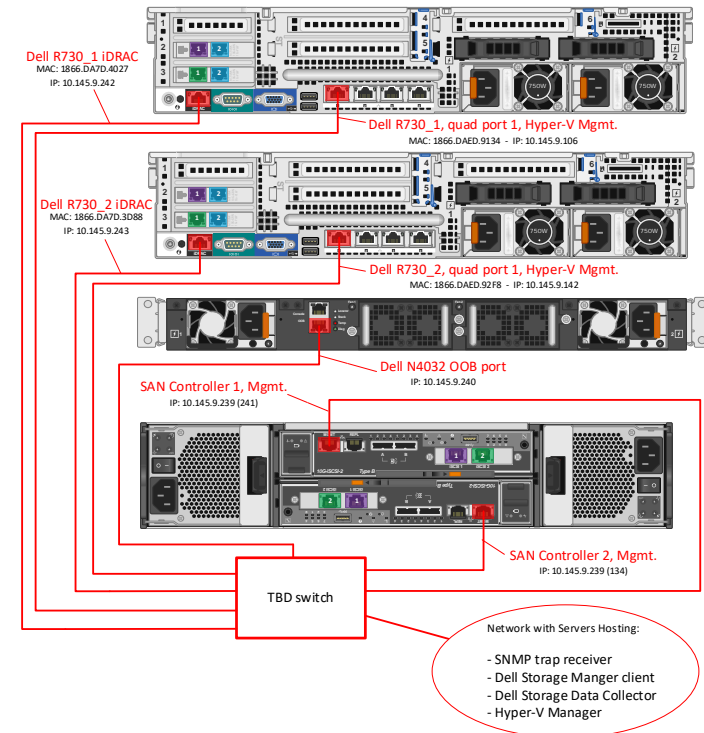
### Connected Vehicle – 10GBase-T Data Network

- (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



# Installation Approach



- OBU Installs



# Basic Install – Antenna Placement





# Basic Install – OBU Unit 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



# Commercial Vehicle Installations



- 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://wydotcwp.wyroad.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
- IPv4/IPv6 connectivity required a lot of effort to resolve



# STAKEHOLDER Q&A



- Please keep your phone muted
- Please use chat box to ask questions
- Questions will be answered in the order in which they were received



# STAY CONNECTED



## 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.wyoroad.info/>

## Contact for CV Pilots Program:

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