CONNECTED VEHICLE PILOT
Deployment Program

Insights, Challenges, and Lessons Learned from the Concept Development Phase – ICF/WYDOT Pilot Site

Kate Hartman, ITS JPO; Vince Garcia, WYDOT; Deepak Gopalakrishna, ICF, Tony English Trihydro

ITS Joint Program Office

TODAY'S AGENDA

- Purpose of this Webinar
  - To share the Comprehensive Deployment Plan from the **ICF/WYDOT** with the stakeholders of connected vehicle technologies.

- Webinar Content
  - Connected Vehicle Pilot Deployment Program Overview
  - **ICF/WYDOT** Comprehensive Deployment Plan
  - Stakeholder Q&A
  - How to Stay Connected

- Webinar Protocol
  - Please mute your phone during the entire webinar
  - You are welcome to ask questions via chatbox 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

ICF/Wyoming DOT

NYCDOT

Tampa (THEA)

STAY CONNECTED

- Participate in Concept Development Phase Webinars for the three Pilot Sites (see website for exact dates and times)

Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016
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Concept of Operations Webinars · **Performance Measurement Webinars** · **Comprehensive Deployment Plan Webinars**

- Visit Program Website for Updates: http://www.its.dot.gov/pilots
- Contact: Kate Hartman, Program Manager, Kate.hartman@dot.gov

MOVING FROM CONCEPT DEVELOPMENT PHASE TO DESIGN/DEPLOY/TEST PHASE

Connected Vehicle Pilot Deployment (up to 50 months)

PHASE 1 (up to 12 months) — Concept Dev.
Progress Gate
In Progress

PHASE 2 (up to 20 months) — Design/Deploy/Test
Progress Gate

PHASE 3 (minimum 18 months) — Maintain/Operate Pilot
Transition

Routine Operations (ongoing) — Post-Pilot Operations

Follow-On Cooperative Agreement
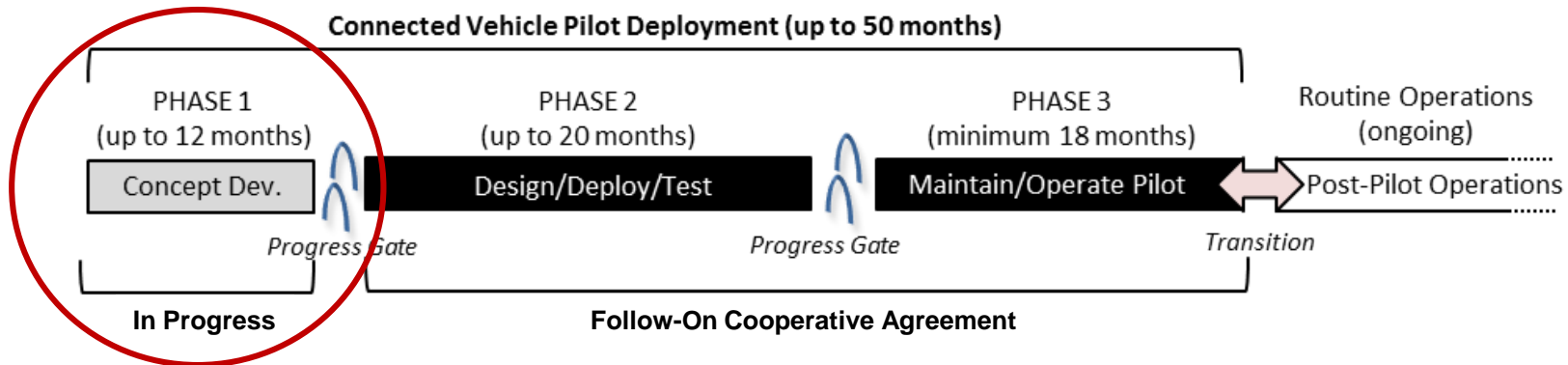
Sites are wrapping up Phase 1; projected Phase 2 Start in September 2016

- Phase 1: Concept Development (*Current Phase*)
  - Creates the foundational plan to enable further design and deployment
  - **Progress Gate: Is the concept ready for deployment?**
- Phase 2: Design/Deploy/Test
  - Detailed design and deployment followed by testing to ensure deployment functions as intended (both technically and institutionally)
  - Progress Gate: Does the system function as planned?
- Phase 3: Maintain/Operate
  - Focus is on assessing the performance of the deployed system
- Post Pilot Operations (CV tech integrated into operational practice)

WYDOT'S PILOT DEPLOYMENT BACKGROUND

Wyoming's I-80 Corridor

Source: WYDOT (Dec 17, 2015)

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

CV Pilot Award

- **September 2015**
  - Phase I awarded
  - Kick-off meeting conducted
  - Activities begin

WYDOT CV Pilot

I-80 Southern Wyoming

Reduce the impact of adverse weather on truck travel along the corridor through CV-based advisories, roadside alerts, parking notifications and dynamic traveler information.

Since the kick-off...

Interstate 80 Incidents
09/04/15 - 08/16/16

✳
Fatal (8)

| Westbound: 5 | Eastbound: 3 |
| (Weather Present: 1) | (Weather Present: 0) |

◆
Injury (105)

| Westbound: 63 | Eastbound: 42 |
| (Weather Present: 15) | (Weather Present: 20) |

Property Damage Only (541)

| Westbound: 282 | Eastbound: 259 |
| (Weather Present: 140) | (Weather Present: 125) |

| **Westbound total:** | **Eastbound total:** |
| 350 | 304 |

Sources: Esri, DeLorme, NAVTEQ, USGS, intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

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

Since the CV Pilot Kick-off Meeting

1,498 crashes
1,923 vehicles

$773.5M
Societal Impact

Response to an incident on I-80

Type	No.	Societal Impact
Fatality	13	$120,891,446
Injury	253	$110,578,475
Property Damage	1,232	$542,080,000

Economic impacts based on figures provided by WYDOT Public Safety. Assumes one moderate injury or one fatality per crash.

Since the CV Pilot Kick-off Meeting

I 80 Westbound Closures from September 1, 2015 to August 10, 2016

I 80 Eastbound Closures from September 1, 2015 to August 10, 2016
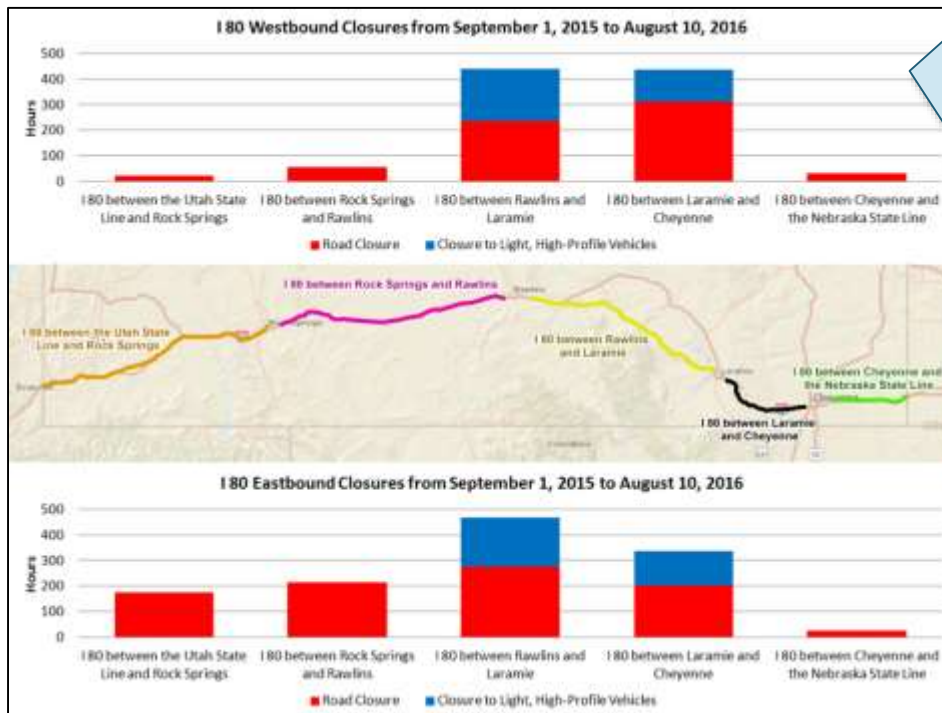
Over the past year…

250 Hours
Full Lane Closures

~180 Hours
High Profile
Vehicle Restriction

37 Days
Inclement Weather

Need for Actionable RW Information

The need for actionable information is growing

Aug 2016

800

26,443

Estimated Firms Subscribed to WYDOT's CVOP

Downloads of WYDOT 511 App*

150

0

Sept 2015
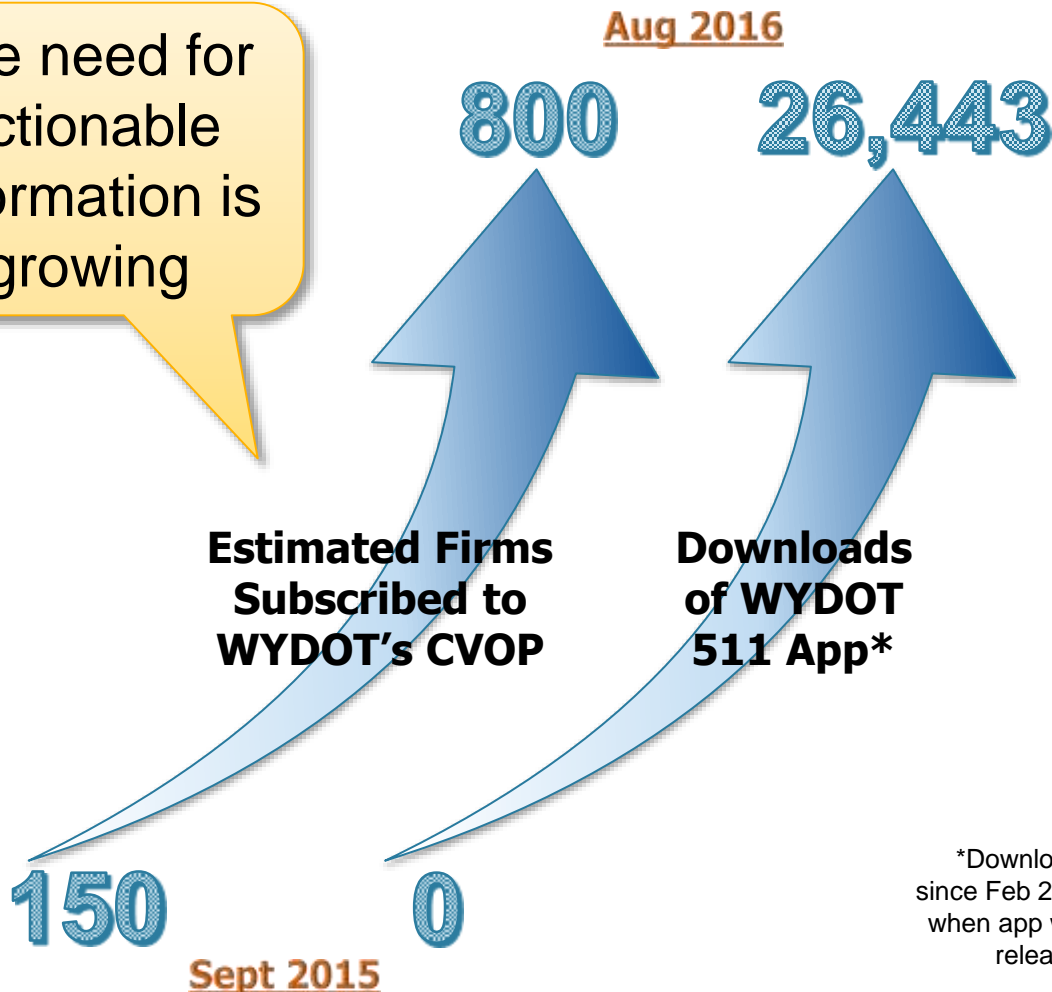
*Downloads since Feb 2016 when app was released

WYDOT's Commercial Vehicle Operator Portal (CVOP)

Created for trucking community and designed with their input. Includes:

o **Road weather forecasts** (surface conditions, visibility, wind)
o **Pre-event forecast** information through FHWA's RWMP's Pathfinder initiative

CVOP Users by Location

Freight firms across the country need I-80 travel information

302 out of 1330 users did not provide location information.

Five states not represented:
Connecticut
Hawaii
Maryland
Rhode Island
Vermont

User Count
1 - 6
7 - 13
14 - 23
24 - 48
49 - 188
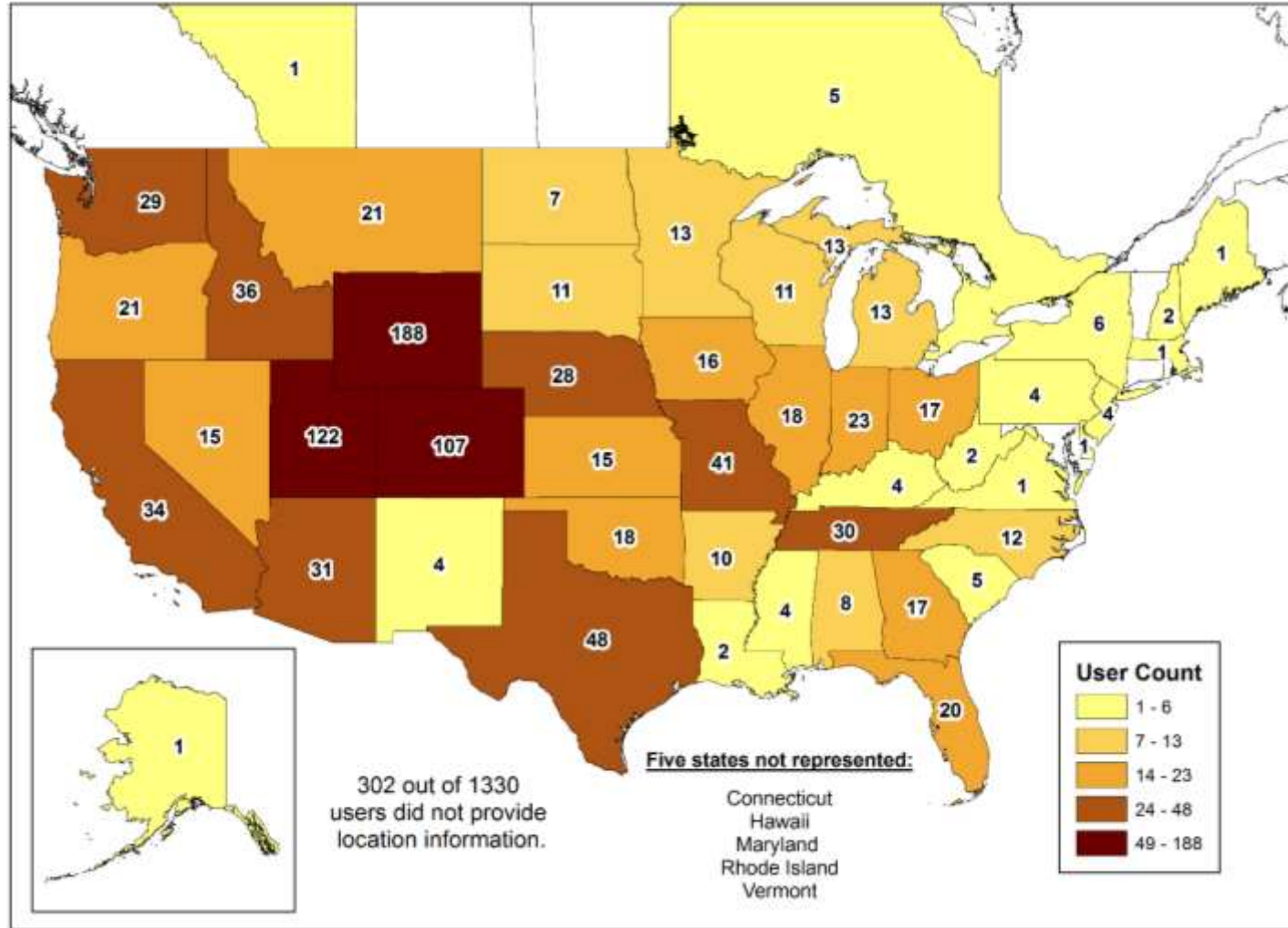
Need to Reduce Workplace Fatalities

Supported by trucking industry leaders and safety advocates across the state
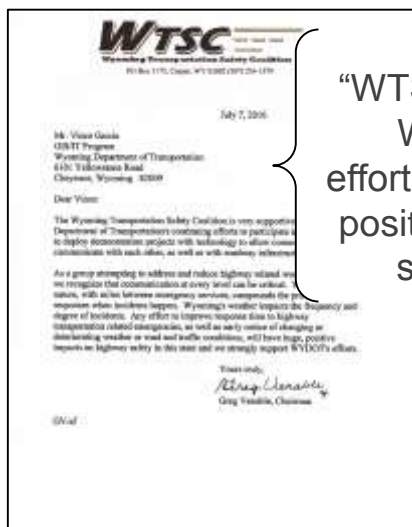
"WTSC is very supportive of WYDOT's continuing efforts…[they] will have huge, positive impacts on highway safety in this state…"
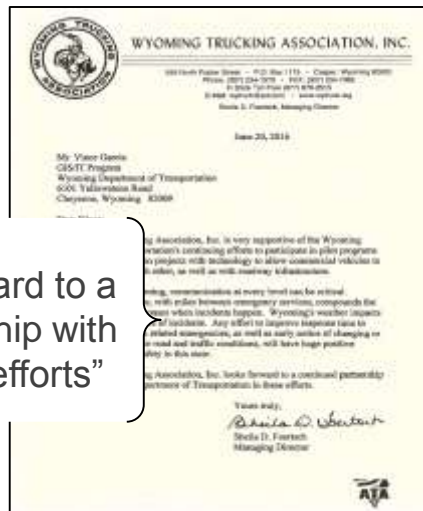
"…WTA looks forward to a continued partnership with WYDOT in these efforts"

3x higher

Average rate of deaths per 100,000 FTE workers is 3x greater than the national average

50%

50% of state operational fatalities in 2014 were transportation related

Source: "Work-related Fatal & Non-Fatal Injury 2014 Report Occupational Epidemiology," Wyoming Department of Workforce Services

Performance Improvements

Road Weather Condition Input

1. Improve road weather condition reports received into the TMC

TMC Information Dissemination

1. Improve ability of the TMC to generate wide area alerts and advisories
2. Efficiently manage closures, restrictions and speed limits
3. Effectively disseminate and receive messages from TMC to en-route vehicles
4. Improve information to commercial vehicle fleet managers

Vehicle/Roadside Alerts & Advisories

1. Effectively transmit and receive V2V messages to reduce incidents and their severity
2. Enhance emergency notifications of a crash

Outcomes

1. Improve speed adherence and reduce speed variation
2. Reduce vehicle crashes

Impacts of WYDOT's CV Pilot
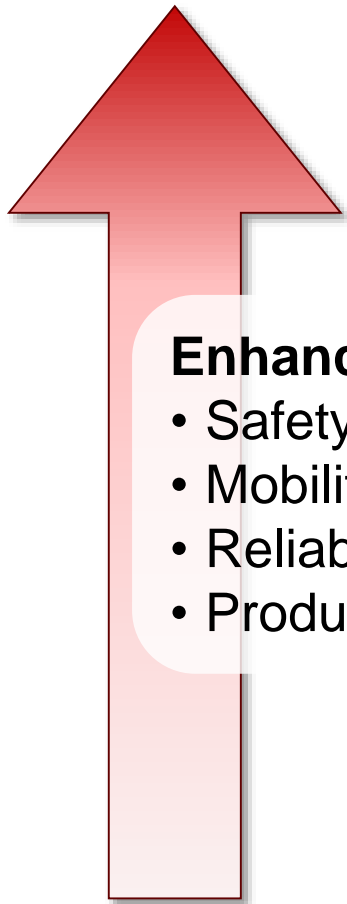
Enhanced:
- Safety
- Mobility
- Reliability
- Productivity

Wyoming I-80 Drivers
- Safer and faster travels on I-80
- Increased amount and reliability of available information

Fleet Managers
- Improved truck and driver productivity and safety

WYDOT
- Reduced crash and road closure
- Improved emergency management
- Enhanced data collection and dissemination capability

US DOT
- Sustainable momentum for nationwide innovation and further deployment of CV-technologies

WYDOT'S PILOT DEPLOYMENT PLAN

Wyoming Connected Vehicle Pilot

- Integrated with TMC
- DSRC Based
- Freight Focused
- Integrated with WYDOT Fleets
- Forward Looking

WYDOT Pilot: DSRC-Based

DSRC-Based

CV Environment
75 Roadside Units on I-80
400 Vehicles with DSRC Connectivity

V2V Applications
Forward Collision Warning
Distress Notification

V2I Applications
Situational Awareness
Spot Weather
Work Zone Warning

WYDOT Pilot: Freight Focused

Freight-Focused

CV Trucks

~150-200 large trucks

~100 small/medium trucks

Fleet Partners

National and Local Truck Companies

Freight Partners

CVOP Users (800 firms)

Wyoming Trucking Association

Third Party Intermediaries

WYDOT Pilot: Integrated with TMC

Integrated with 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

WYDOT Pilot: 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

Standards-Driven

Integration with
Third-Party
Intermediaries

Integration with
Satellite Delivery of
TIMs

Close coordination
with other CV sites

**Forward
Thinking**
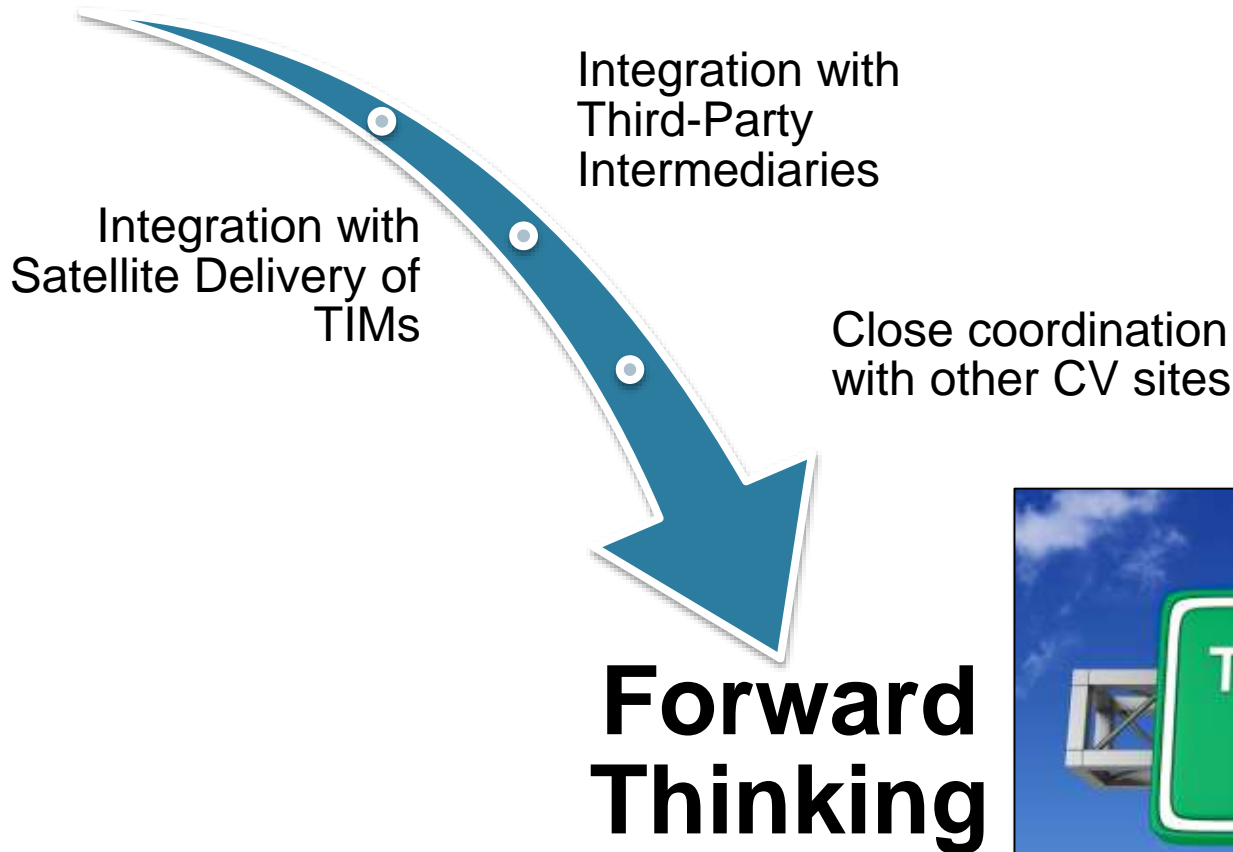
WYDOT'S PILOT SYSTEM OVERVIEW

System Overview

WYDOT's CV Pilot System

Vehicle System

Wyoming CV System

Roadside Infrastructure

80

Back office system

External Interfaces
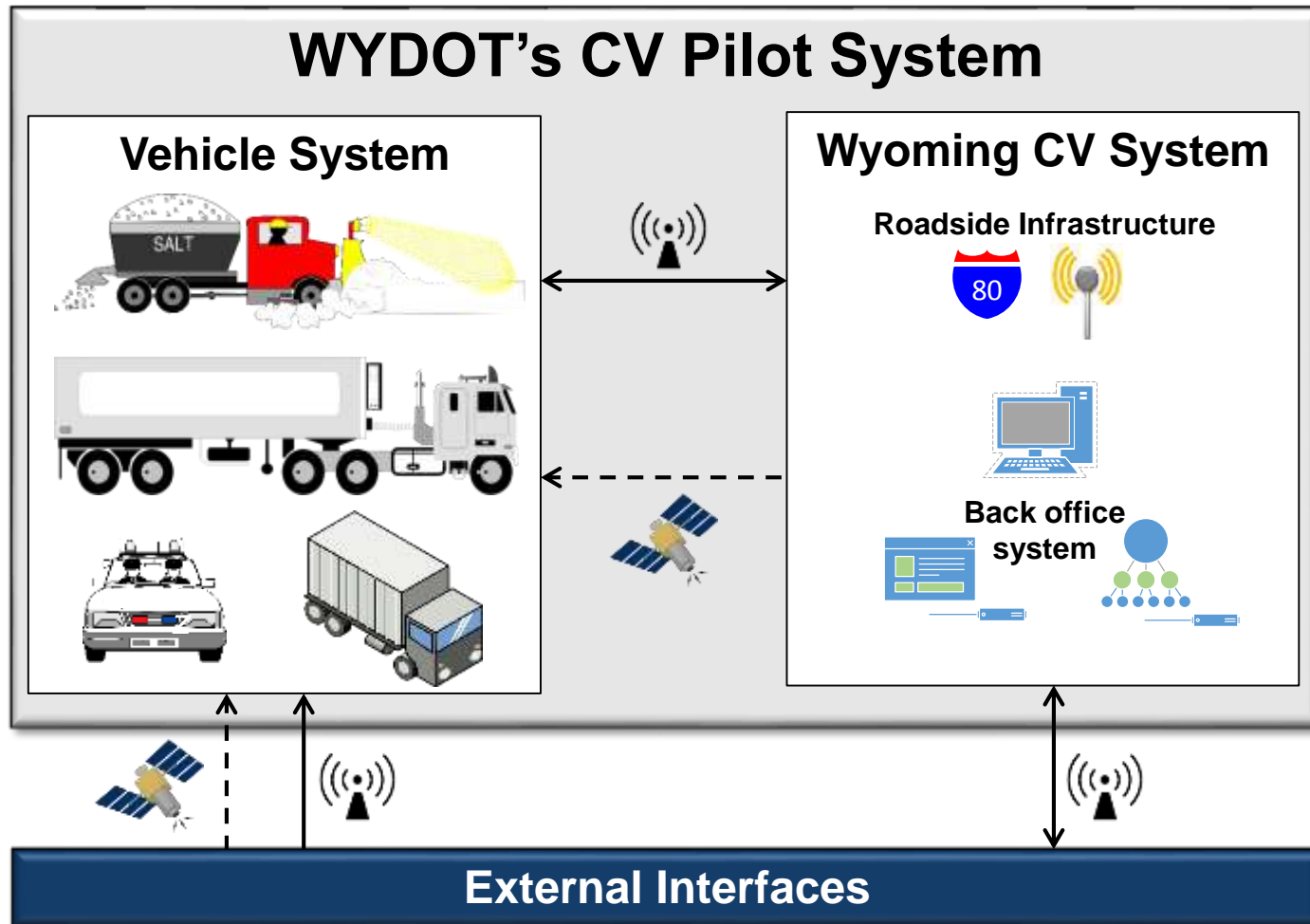
Vehicle System

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 Part I

- 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. Basic Vehicles

On-board Vehicle Technologies

- OBU with DSRC only
- OBU with DSRC and Satellite Receiver
- Human Machine Interface
- CAN Bus Integration
- Environmental Sensors
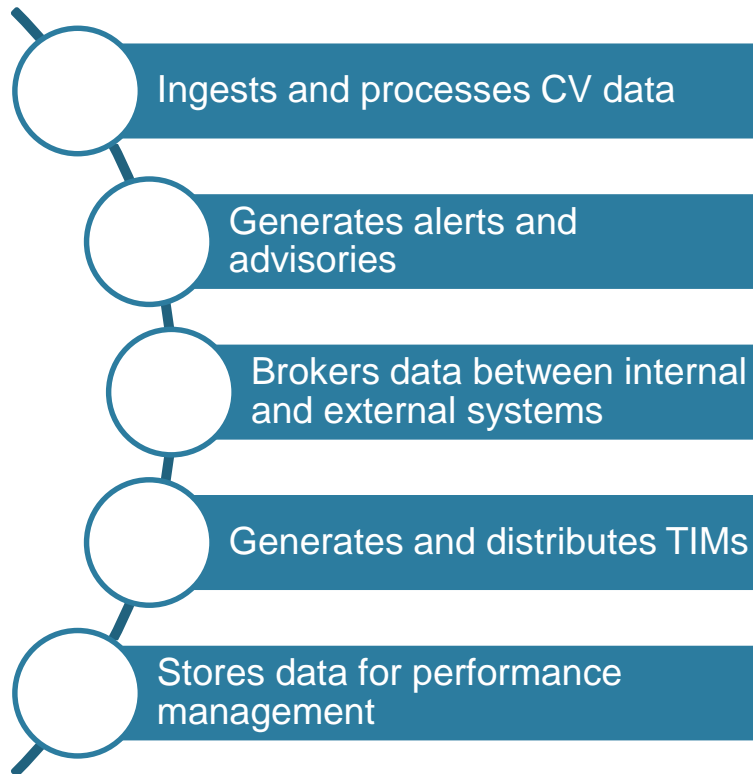
Wyoming CV System

Wyoming CV Pilot System

External Interfaces

- US DOT Interfaces (e.g. SCMS)
- WYDOT Interfaces (e.g. ATMS and ATIS Systems at the TMC)
- Weather

CV Subsystems

- Roadside Units
- Operational Data Environment
- PikAlert® System
- WYDOT Data Broker
- WYDOT Data Warehouse

Ingests and processes CV data

Generates alerts and advisories

Brokers data between internal and external systems

Generates and distributes TIMs

Stores data for performance management

CV Applications Overview

On-Board Applications

- Applications available to equipped vehicles

TMC Ops Applications

- Support for WYDOT Traveler Information and Traffic Management

Forward Collision Warning

Slow moving vehicles like Snow Plows or Heavy equipped trucks, or in low visibility conditions

Host vehicle receives BSM information from remote vehicles.
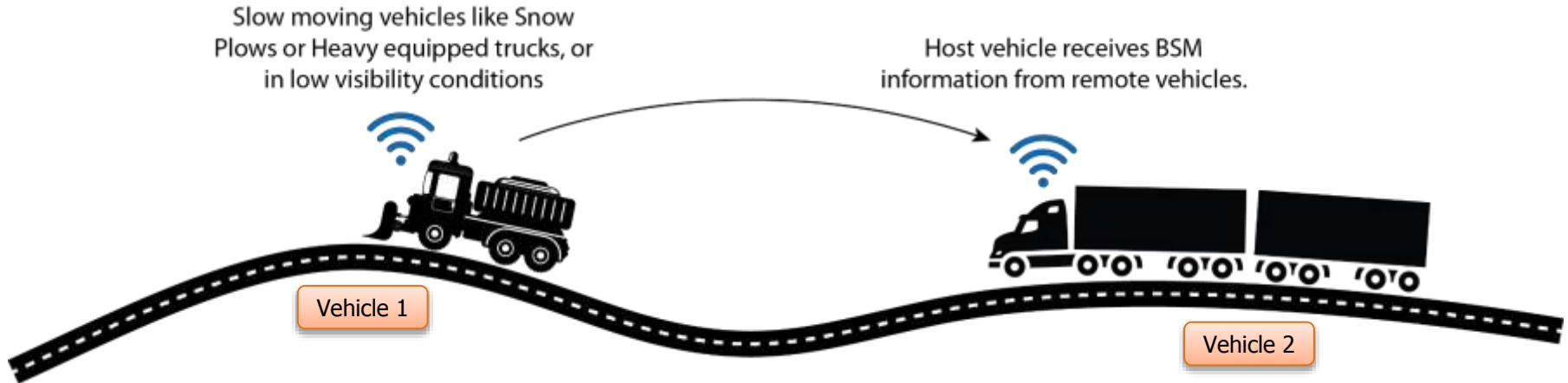
Vehicle 1

Vehicle 2

- Impending front-end collision warning
- Data sent to approaching vehicles (from vehicle 1 to vehicle 2)
- Same direction of travel
- All roadway geometries
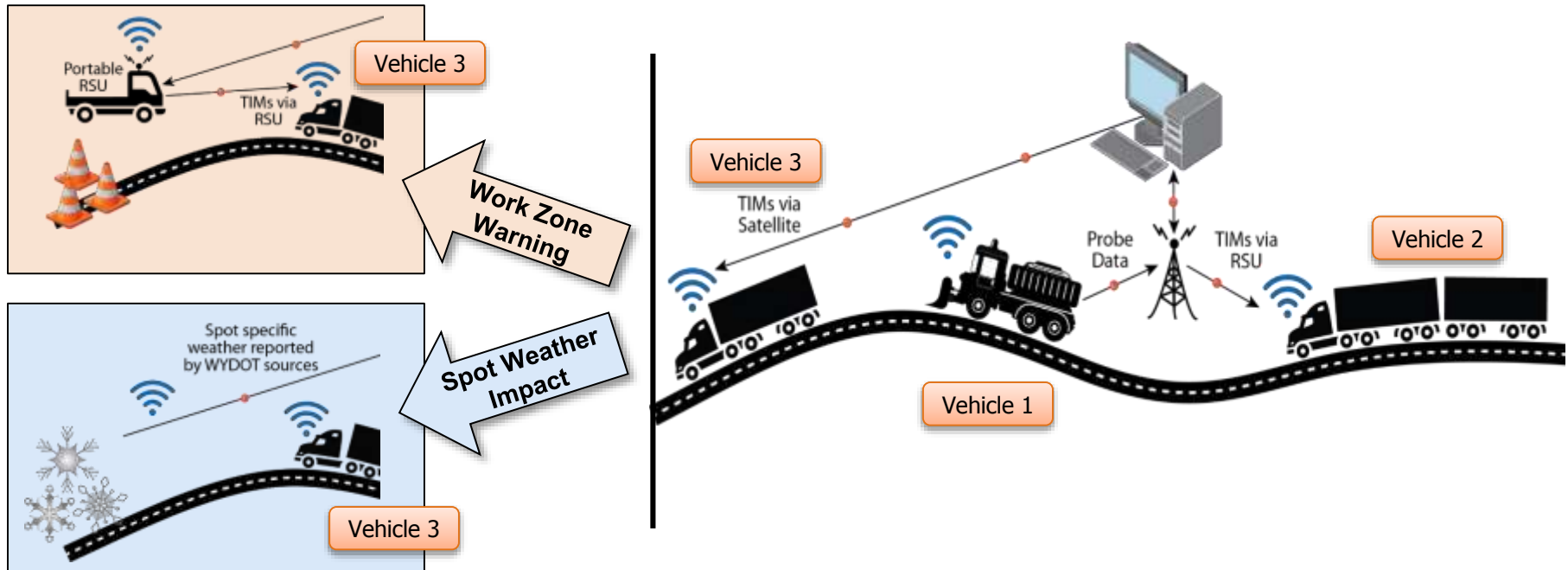
- Probe data collected from WYDOT fleet to supplement existing observations

- Downstream road conditions (speed and vehicle restrictions, incidents, parking, road closures etc.) sent via a **Traveler Information Message (TIM)**

- Similar applications included in the pilot:

  o **Work Zone Warning**: Unsafe work zone conditions (obstructions, closures, shifts, etc.)

  o **Spot Weather Impact Warning**: Localized road weather information (fog, ice, etc.)

Distress Notification
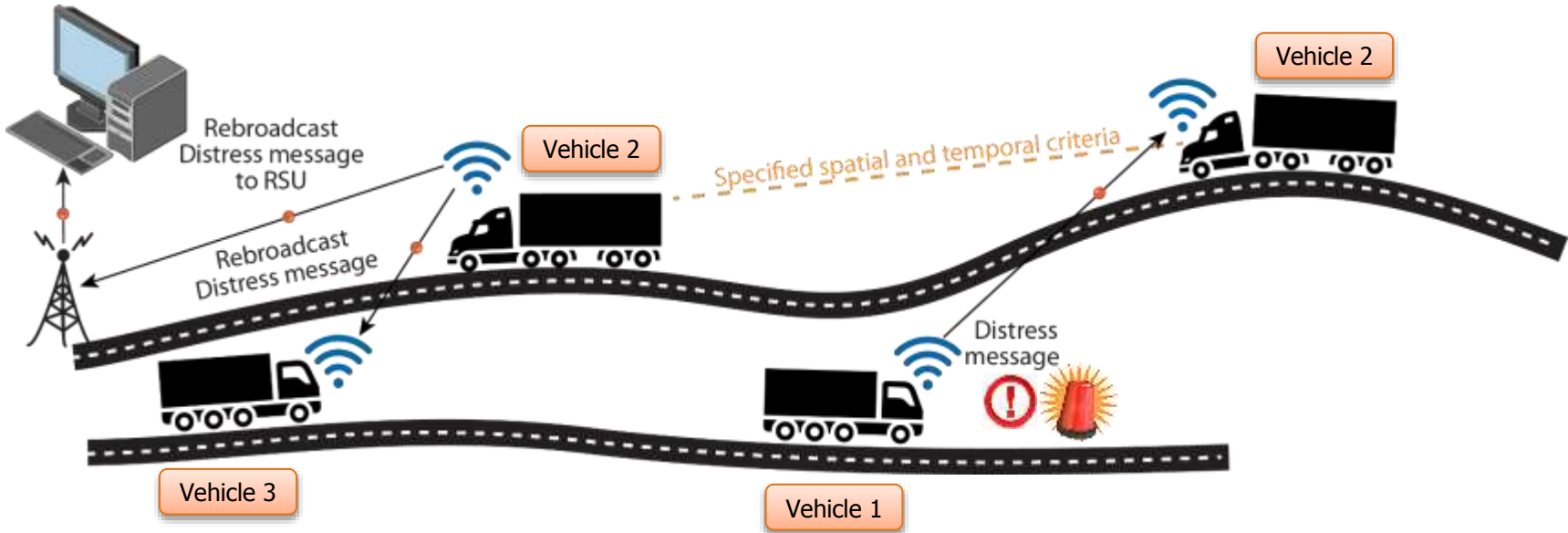
- Generation and broadcast of distress message (e.g., Mayday)
- CV and RSU within vicinity receive and forward message

LESSONS LEARNED

PHASE I ACCOMPLISHMENTS AND LESSONS LEARNED

Phase I Achievements

WYDOT Phase I planning achieved successful incorporation of USDOT CV required elements:

- Applications supporting a real need
- DSRC integration
- SCMS use and interfaces
- Share data
- Develop open source code
- Use of CVRIA and SET-IT tools
- Successful team framework

Approved Phase I documents:

☑ Program Management Plan

☑ Concept of Operations

☑ Security Management Operational Concept

☑ Safety Management Plan

☑ Performance Measurement and Evaluation Support Plan

☑ Application Deployment Plan

☑ Participant Training & Education Plan

☑ Deployment Outreach Plan

- Be prepared for concept evolution – must meet real needs!

- Leverage existing resources but understand limitations with respect to pilot

- Developing verifiable system requirements is challenging in the CV arena

- Develop an approach to integrate CV pilot with existing transportation systems management and operations

Address commercial operator's priorities and concerns (privacy, liability, flexibility)

Once initial concept and user needs are stable, engage with vendors

Plan with post-pilot operation in mind

Balance data needs (privacy/security vs. performance measurement)

Formalized agreements with private partners take time. Start with initial letters of support

Engage procurement and contracting personnel early

Leverage local stakeholders and champions. Engage leadership early

Be opportunistic. Take advantage of evolving trends and interest

PHASE 2 AND PHASE 3

MOVING FORWARD

Phase 2 and Phase 3 Approach

Results of Phase 1 Planning + **New Staff Capabilities** + **Finalized Partnerships** = **Phase 2 and 3 Approach**

Results of Phase 1 Planning
- Robust ConOps
- Verifiable System Requirements
- IRB Approval
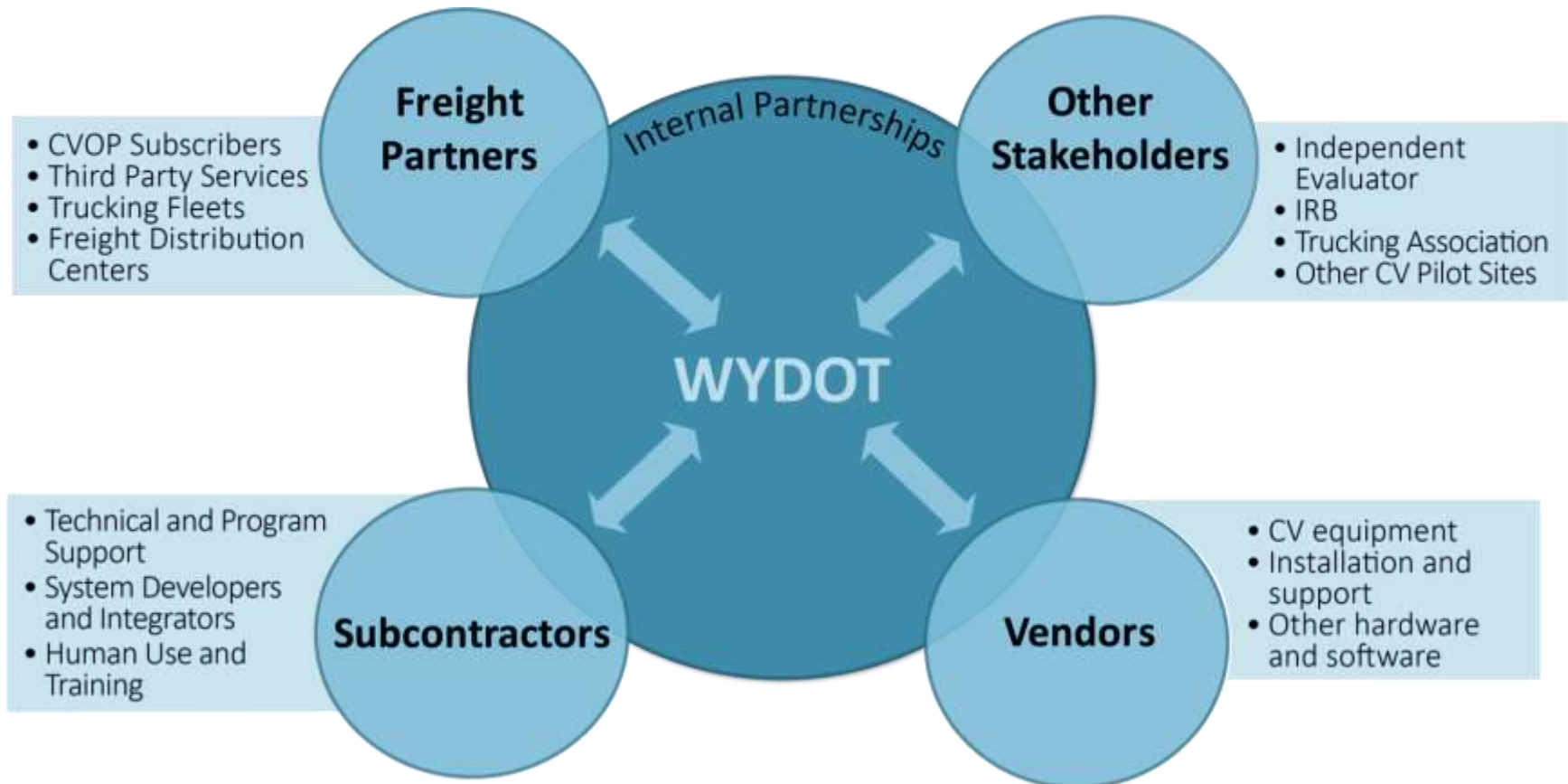- Strong PMBOK based management
- Vendor Engagement
- PM Planning

New Staff Capabilities
- Additional SE Staff
- Testing and Readiness Expertise
- Software developers
- Outreach experts

Finalized Partnerships
- Finalized Memorandums of Understanding
- Finalized scope of work
- Vendor specification documents
- Internal workload management

Phase 2 and 3 Approach
- Agile Application development
- Leveraging winter of 2017 to test early concepts
- Strong outreach plan
- Comprehensive Performance Management

Partnership Framework

- CVOP Subscribers
- Third Party Services
- Trucking Fleets
- Freight Distribution Centers

Freight Partners

Internal Partnerships

Other Stakeholders

- Independent Evaluator
- IRB
- Trucking Association
- Other CV Pilot Sites

WYDOT

- Technical and Program Support
- System Developers and Integrators
- Human Use and Training

Subcontractors

Vendors

- CV equipment
- Installation and support
- Other hardware and software

Next Steps and Activities

Updates to all Phase I documents (2016)

Formalizing partnerships with fleet partners (Early 2017)

System architecture and design development (Early 2017)

Acquisition and Installation Planning and Procurement (Throughout 2017)

Application development (throughout 2017)

Early testing of applications (winter of 2017)

Next Steps and Activities

Operational Readiness Testing in early 2018

System Operations and Maintenance starting May 2018 for 18 months

Post-Pilot Transition Planning

Support for performance measurement and evaluation (throughout)

Standards support (throughout)

Stakeholder outreach (throughout)

STAKEHOLDER Q&A

- Please keep your phone muted

- Please use chatbox to ask questions

- Questions will be answered in the order in which they were received

STAY CONNECTED

Contact for CV Pilots Program:

Kate Hartman, Program Manager

Kate.Hartman@dot.gov

Join us for the *Getting Ready for Deployment* Series

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

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

Twitter: @ITSJPODirector

Facebook:
https://www.facebook.com/USDOTResearch

CV Pilot Sites' Comprehensive Deployment Plan Webinars

- August 22 2016 /1:00-2:00 pm (Eastern) *ICF/WYDOT Comprehensive Deployment Plan Webinar*

- August 22 2016/3:00-4:00 pm (Eastern) *NYCDOT Comprehensive Deployment Plan Webinar*

- August 19 2016/1:00-2:00 pm (Eastern) *Tampa (THEA) Comprehensive Deployment Plan Webinar*

Please visit the CV pilots website for the recording and the briefing material of the previous webinars.