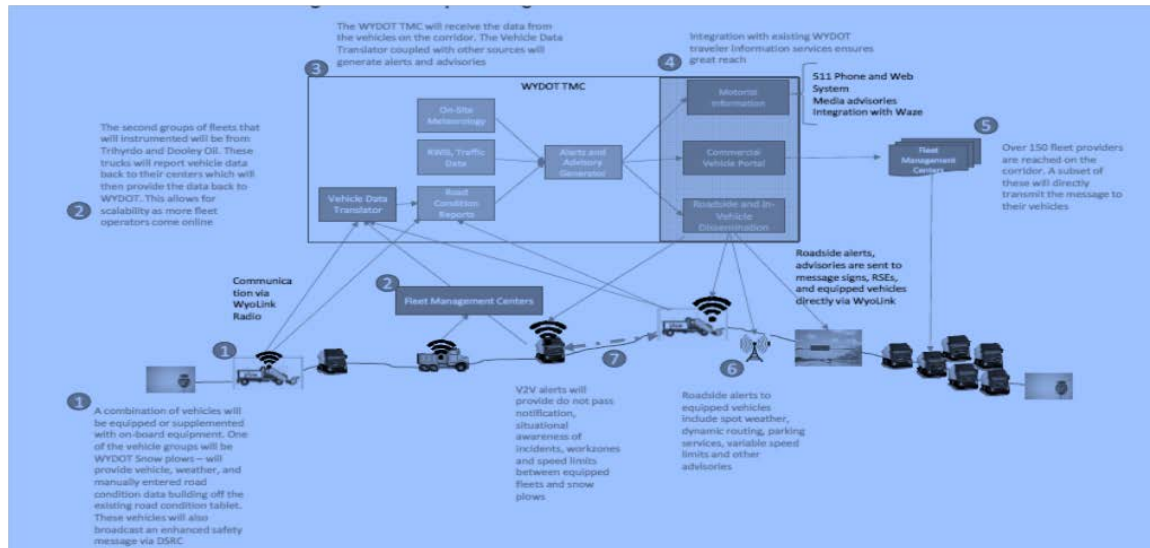


Wyoming DOT Connected Vehicle Pilot Deployment Program



Overview

U.S Department of Transportation

Connected Vehicle Pilot Deployment Program Phase I

Kick-off Meeting

09/30/2015

Presentation Outline

- **Introduction to the Team**
- **Problem Definition and Current Capabilities**
- **Proposed Pilot Overview**
- **Implementation Approach**
- **Next Steps**



The Team



Phase I Team - Leads



Deepak Gopalakrishna
Project Development Lead
ICF



Vince Garcia
Concept Development Lead
Wyoming DOT



Tony English
Systems Development Lead
TriHydro



Ali Ragan
Outreach and Communications
POC
Wyoming DOT

Phase I Team –Technical Experts



Fred Kitchener
Weather and Performance
Management
McFarland Management



Amanda Anderson
Weather and
Connected Vehicles
NCAR



Michael Pack
Data, Connected
Vehicles
UMD-CATT Lab



Dr. Mohammed Ahmed
Analysis, Modeling and
Simulation
University of Wyoming

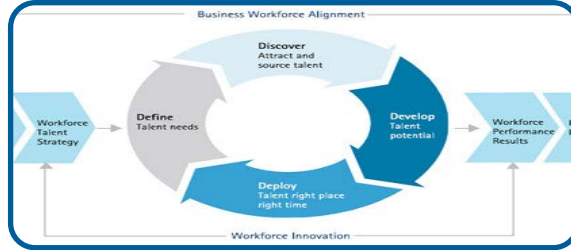


Dr. Rhonda Young
Analysis, Modeling and
Simulation
University of Wyoming



Dr. Gerry Wiener
Weather and CV
NCAR

Overall Team Structure



Phase I

- Led by ICF
- Partners
 - Wyoming DOT
 - Trihydro
 - NCAR
 - Univ of Wyoming
 - CATT Lab
 - McFarland Mgmt

Phase II

- **Led by Wyoming DOT**
- Partners
 - ICF
 - Trihydro
 - NCAR
 - Univ of Wyoming
 - CATT Lab
 - McFarland Mgmt

Phase III

- **Led by Wyoming DOT**
- Partners
 - ICF
 - Trihydro
 - NCAR
 - Univ of Wyoming
 - CATT Lab
 - McFarland Mgmt

- **New Partners**
- DSRC Radio Vendors
- On-board equipment vendors
- Data providers
- Weather Sensor Developers
- Fleet Operators

- **New Partners**
 - Fleet Operators

Stakeholders throughout the course of the project.

- Wyoming Trucking Association
- Wyoming Highway Patrol
- Wyoming Workforce Development
- Wyoming Chamber of Commerce
- Freight Operators
- Oil and Gas Industry Representatives

Problem Definition and Current Capabilities



A State Trooper responding to multi-vehicle incident

The Problem

- High profile, multiple vehicle crashes have occurred along Interstate 80 in Wyoming that have resulted in loss of life, extended closures and a direct impact on the nation's economy

200

Number of truck blowovers were reported related to high wind events in four years



86 & 8

Road closures in 5 years for adverse weather & average duration for closures in hours

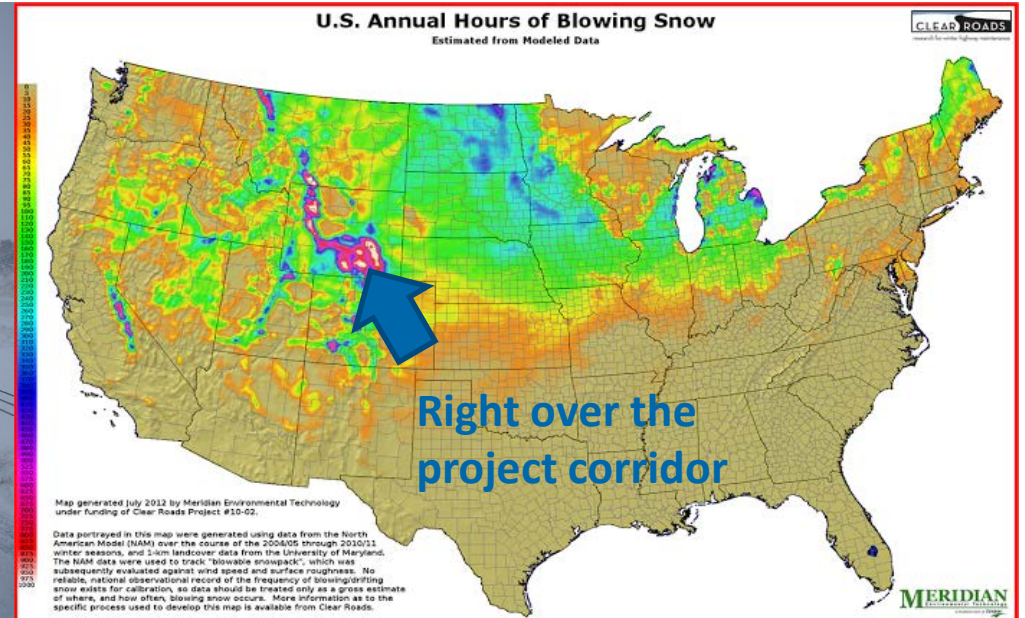


\$11.7 Million

Estimated economic cost due each closure

The Problem – A challenging mix of weather and road weather conditions

- Blowing Snow
- High-Wind
- Fires
- Visibility



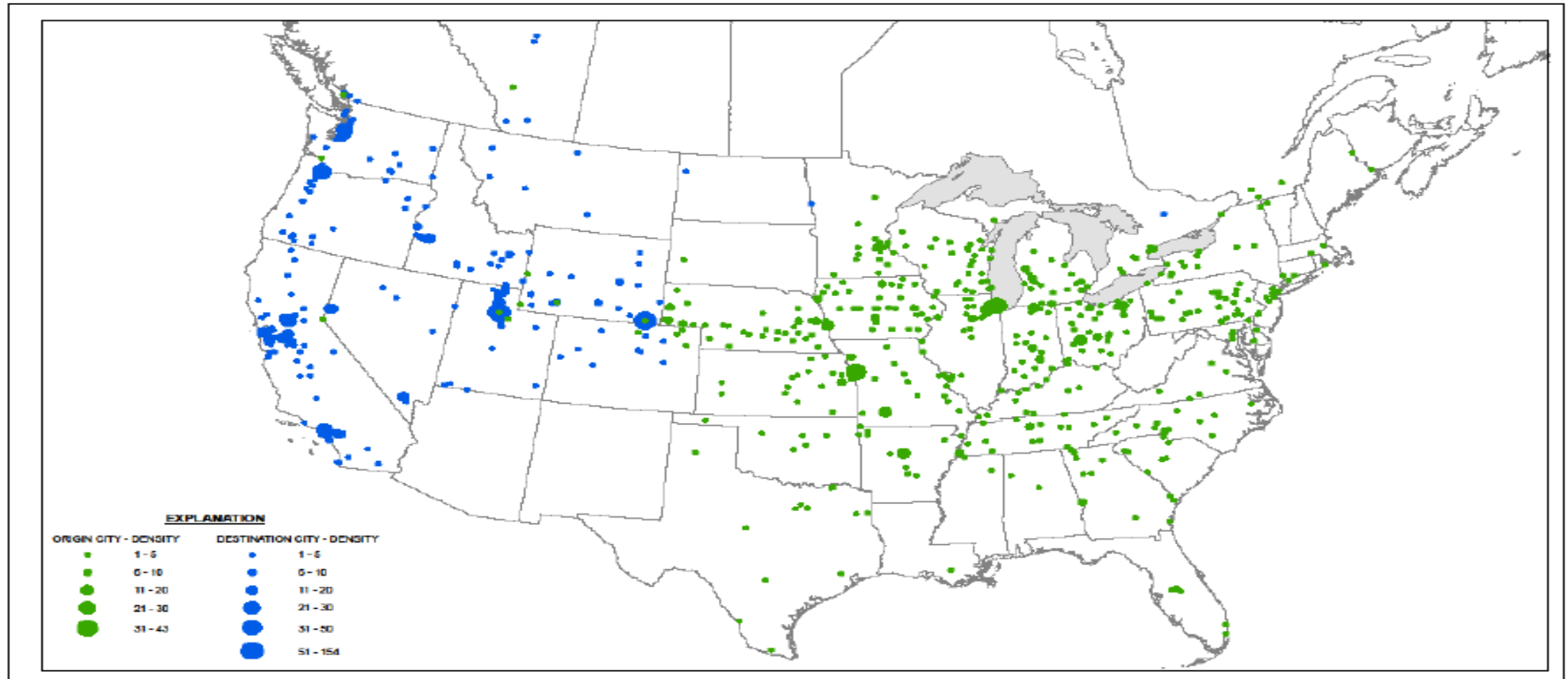
Contributing Factors

- High elevation – highest point along the entire length of transcontinental Interstate 80
- Major truck corridor
- Slow moving trucks cause passenger vehicles to take risks that they would not normally take
- Distances between towns along the corridor range from 50 to 115 miles
- Limited parking and no alternate routes

Along parts of I-80 in southern Wyoming, freight traffic comprises 30 to 55% of the traffic stream. Seasonal truck percentages can be as high as 70%. I-80 annual average daily truck traffic (AADTT) ranges from 4,000 to 6,700 trucks per day.

National Impacts

Origins and Destinations of Westbound Freight on I-80



(Source: FHWA-WY- 09/09F Interstate 80 Freight Corridor Analysis)

Some videos from the TMCs

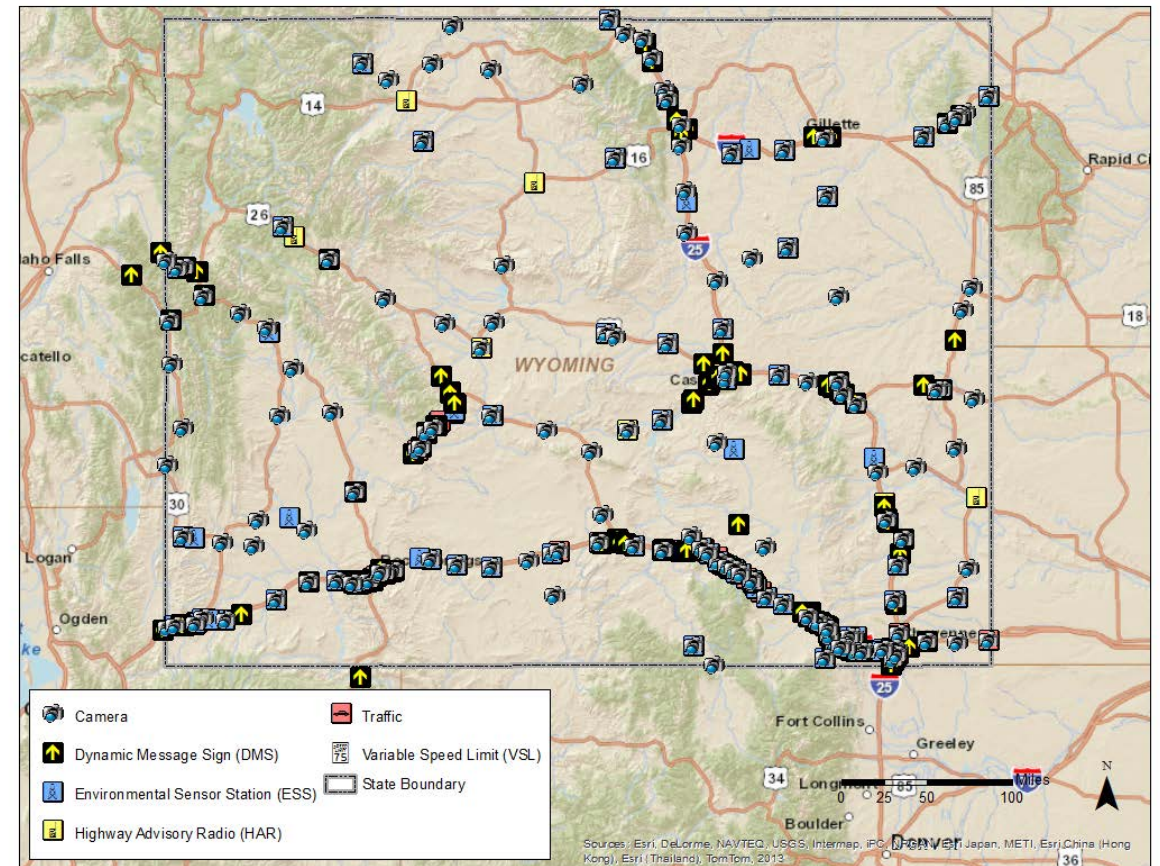
Source: Wyoming Department of Transportation and YouTube, Marci Hugentobler, <https://www.youtube.com/watch?v=IxlvxvG8zOE>

Ongoing Challenges

- Limitations of fixed detection leads to significant gaps in determining road and weather conditions
 - Reduces the effectiveness of strategies like variable speed limits
 - Reduces ability to monitor rapidly changing conditions
- The ability to communicate actionable information to travelers already on the roadway continues to be a challenge
 - Providing key alternatives to truckers (parking, services) while they are on the road
 - Influencing travel decisions of commercial vehicle operators is more difficult than influencing passenger vehicle drivers

Current Capabilities in the Corridor

- Wyoming DOT: A national leader in transportation systems management especially for adverse weather
 - Sophisticated integration of weather and meteorology into operations including on-site meteorologist at TMC
 - Network of roadside systems to provide traveler information
 - RWIS
 - VSL signs
 - Highway Advisory Radios
 - Dedicated backhaul radio system (WyoLink)
 - Citizen reporting lets travelers report conditions to WYDOT
 - Strong ITS and GIS development team



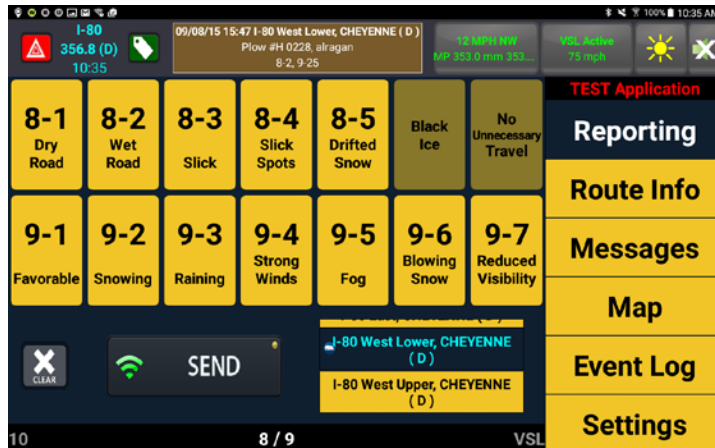
Source: Wyoming DOT

Current Capabilities in the Corridor

Recent initiatives have focused on improving the way information is collected and shared with the public

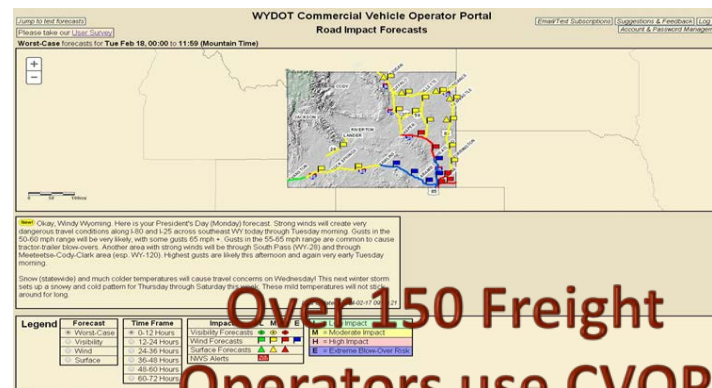
Road Condition Reporting App

An FHWA-funded pilot project allows maintenance employees to report road conditions through a tablet mounted in snow plows and other maintenance vehicles.



CVOP

A website was designed to give commercial vehicle operators access to forecasted road condition and wind information. Reports are created by WYDOT's onsite meteorologist.



Over 150 Freight Operators use CVOP

Smart TV Display

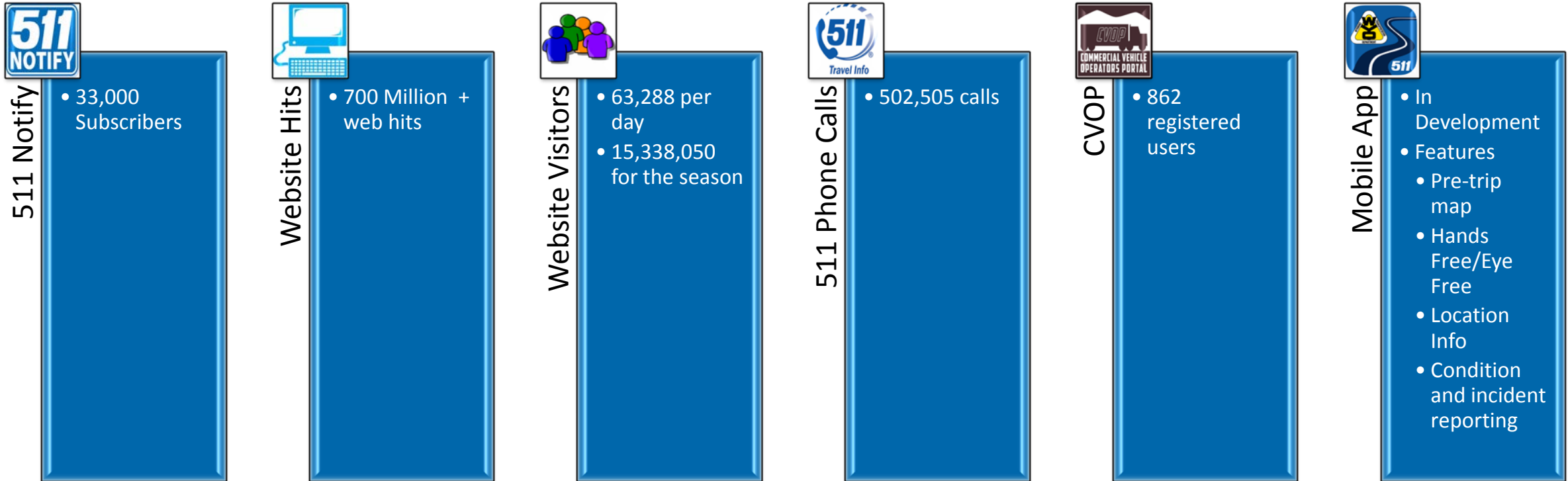
Businesses can request custom road-condition websites that show current conditions along with webcam images. The sites are optimized to display on Smart TVs.



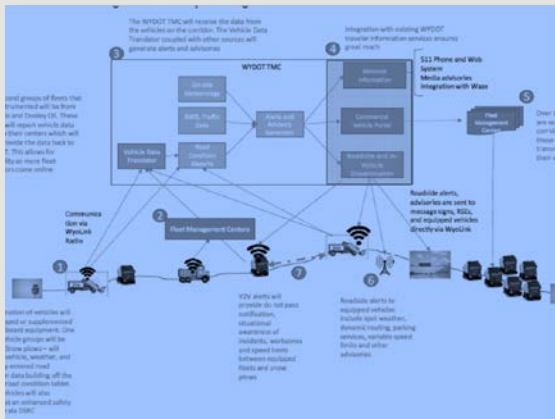
Source (all pictures): Wyoming DOT

Current Capabilities in the Corridor

There is a strong demand for information, and the TMC coordinates it all.



Source: Wyoming DOT



Proposed Pilot Overview

Pilot Principles

Operational

- Not an R&D effort. To be used by WYDOT Operations for immediate needs

Scalable and Sustainable

- Ability to incorporate new fleets and applications

Evolutionary

- Ability to start with a few applications/services but grow to an eco-system of services

Replicable

- Be a model deployment for rural freight-heavy corridors

Leveraged

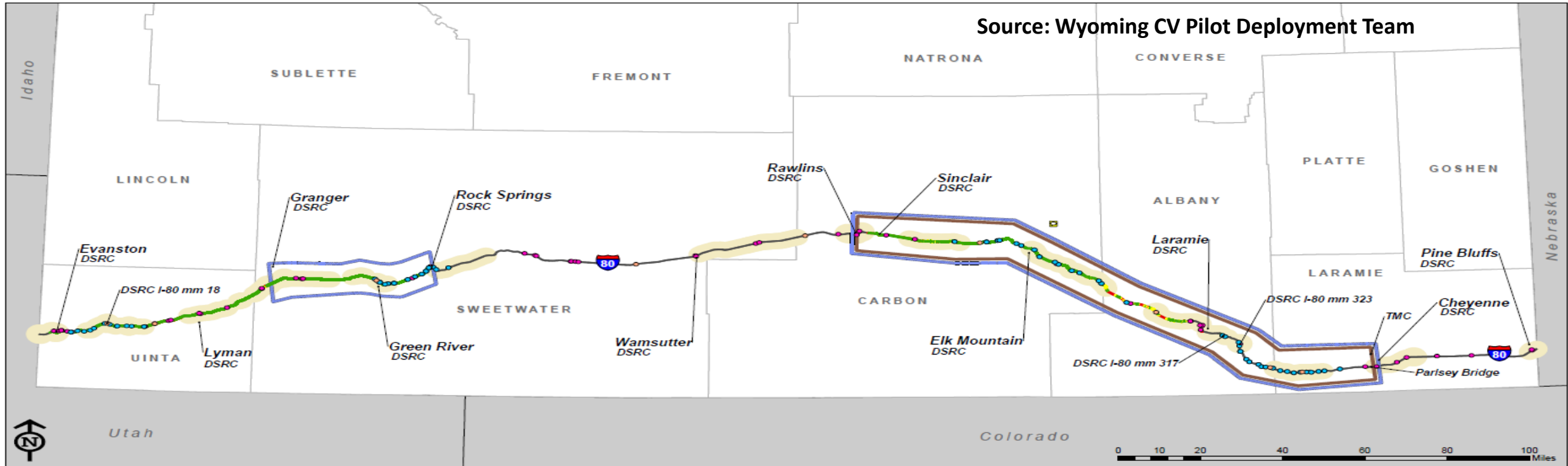
- Maximize use of already created federal investments and state initiatives. Do not recreate the wheel

Source: Wyoming CV Pilot Deployment Team

Pilot Location

Wyoming I-80 Corridor - Connected Vehicle Map

Source: Wyoming CV Pilot Deployment Team



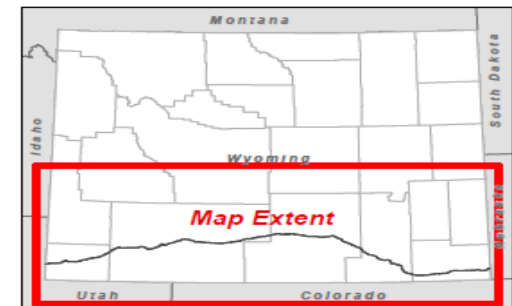
Created by: mddrake Date: 3/23/2015



The State of Wyoming and its agencies make no express or implied warranties as to this map and the data it displays. Users of this information should review or consult the primary data and information sources to ascertain the reliability or usability of the information. The State of Wyoming and its agencies assume no liability associated with the use or misuse of this information and specifically retain sovereign immunity and all defenses available to them by law.

Legend

- High Profile Wind Warning Area
- AVL/Tablet Snow Plows
- STIP Areas 2015-2018
- WyoLink - Signal Strength Good
- WyoLink - Signal Strength Spotty
- WyoLink - Signal Strength Unreliable
- I-80, Wyoming
- Possible Locations Roadside DSRC (Going into/out of each town off I-80 for supporting VSL Application. These include locations with mm labels)
- WiFi Locations (9 within 500 ft of I-80)
- VSL Devices (122 on I-80)
- Truck Parking (55 on I-80)

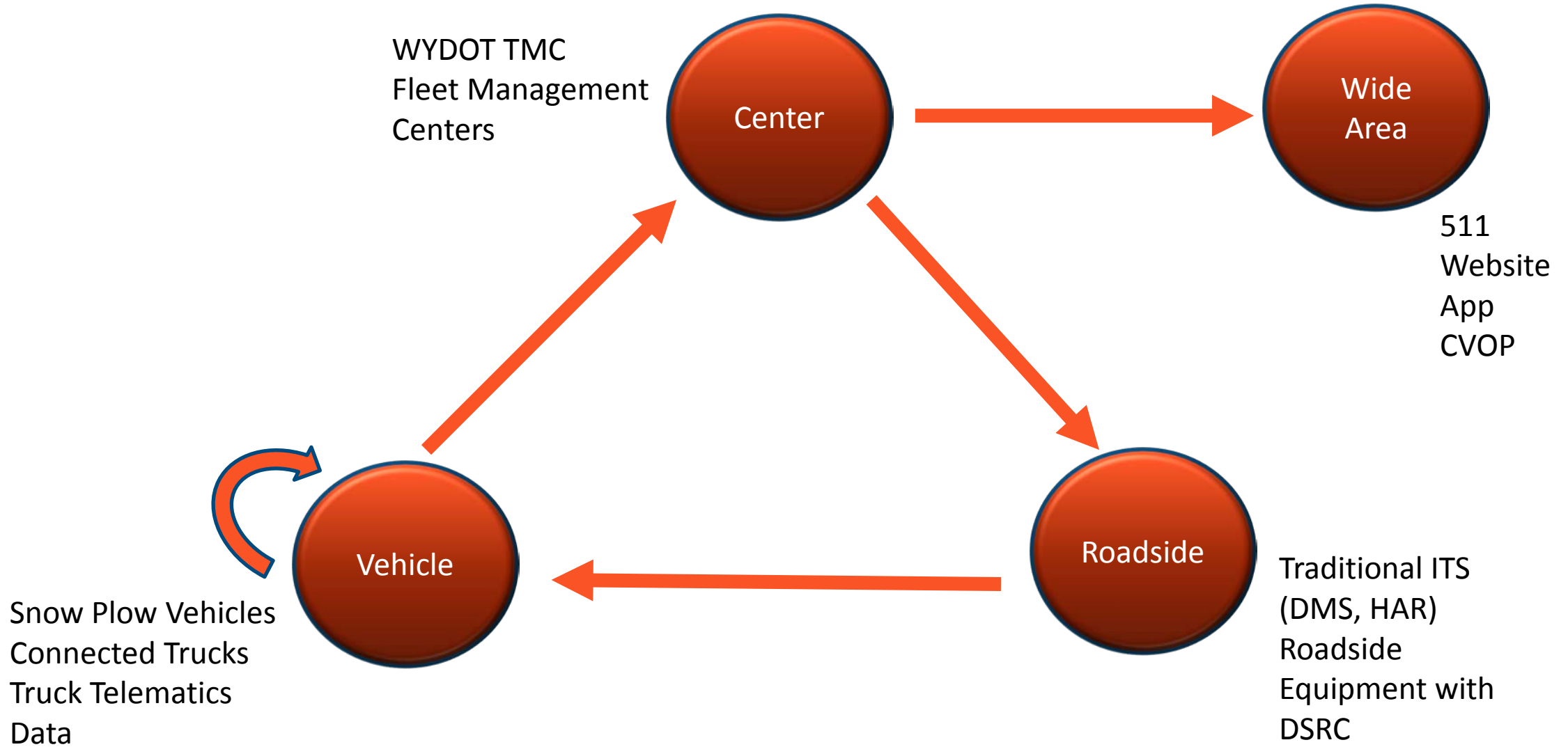


Pilot Vision

Focusing on the needs of the commercial vehicle operator in the State of Wyoming, the pilot will develop applications that use vehicle to infrastructure and vehicle to vehicle connectivity to support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance.

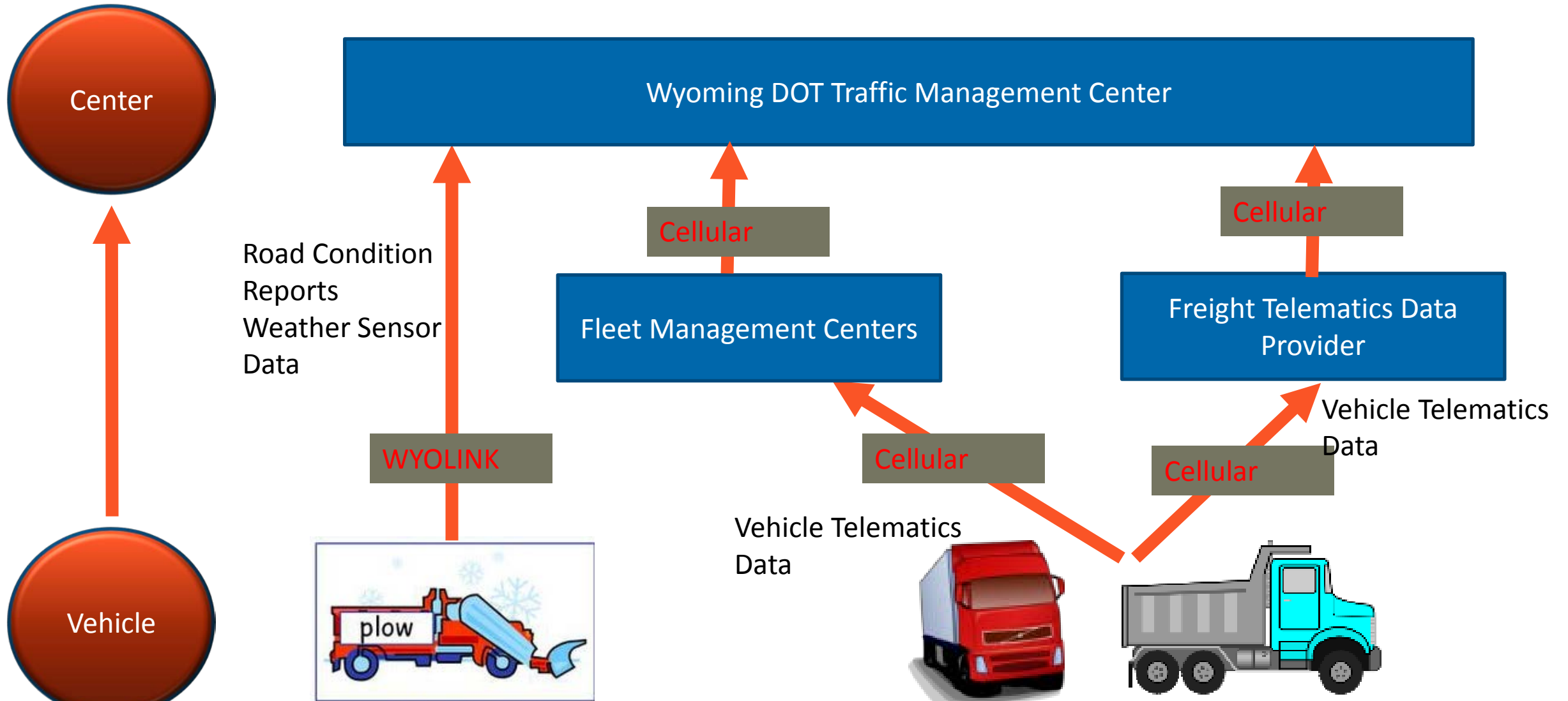
Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems)

Pilot Components (1/6)



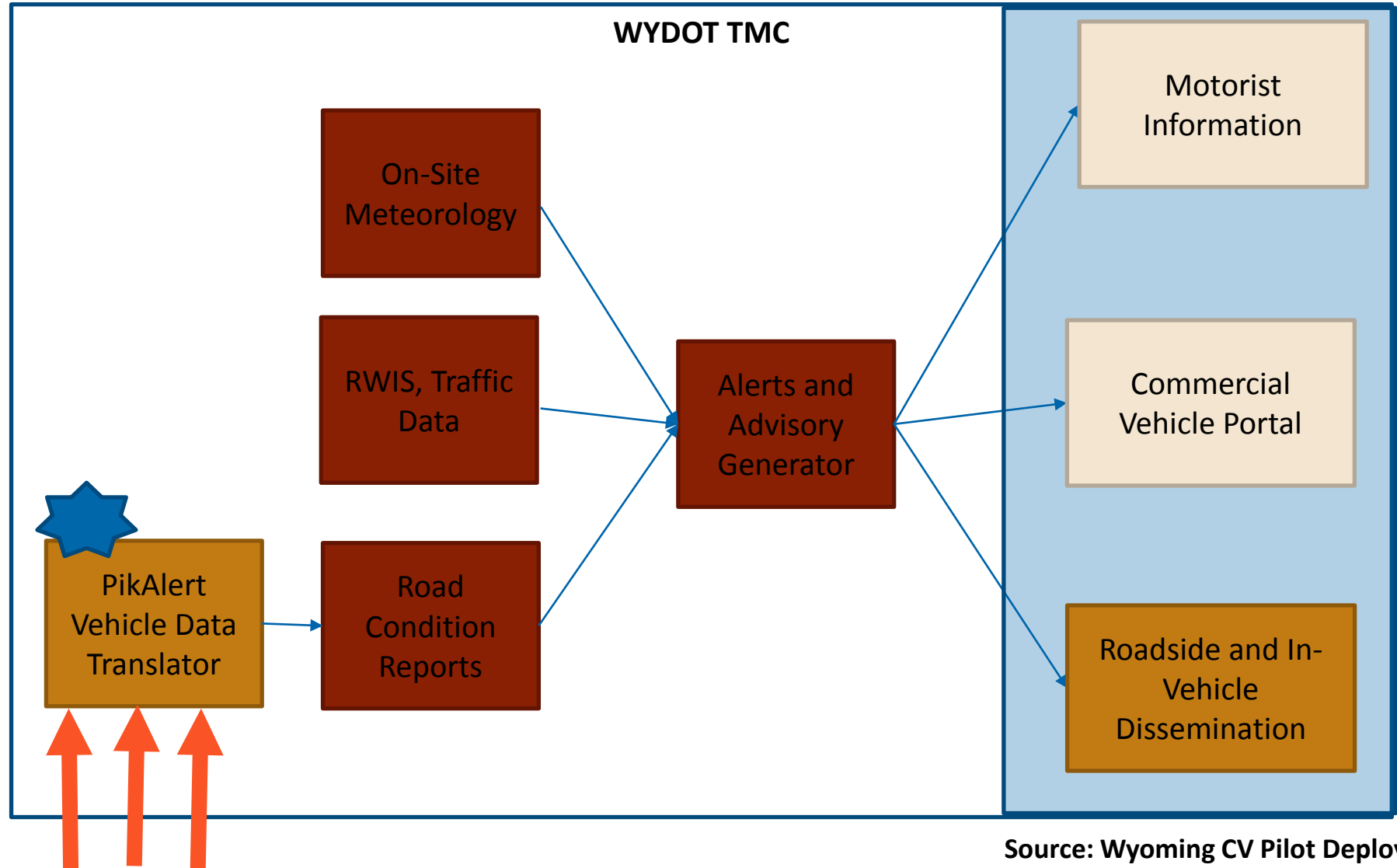
Source: Wyoming CV Pilot Deployment Team

Pilot Components (2/6)



Source: Wyoming CV Pilot Deployment Team

Pilot Components (3/6)

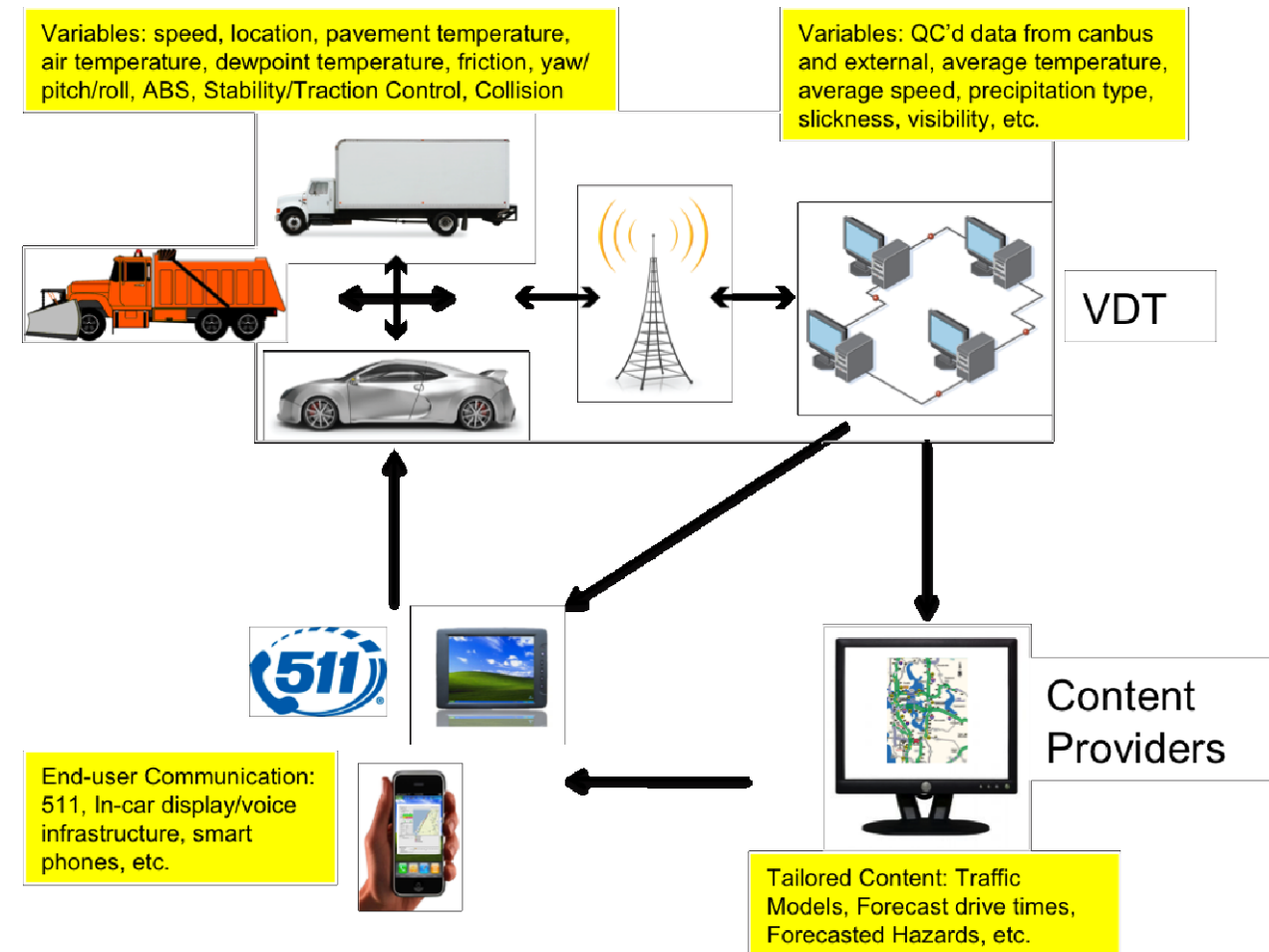


Source: Wyoming CV Pilot Deployment Team



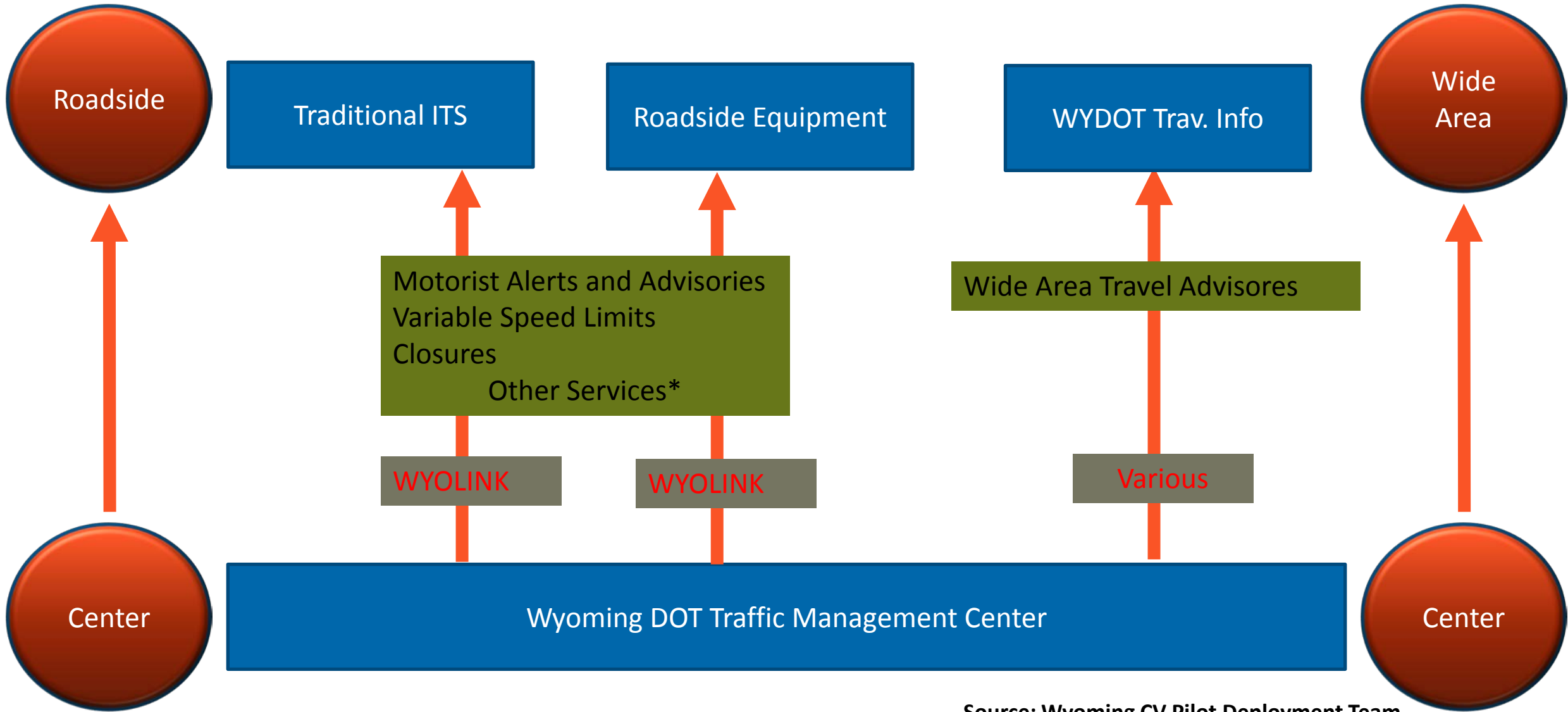
Use of Pikalert for WYDOT Deployment

- Quality checking and aggregation of incoming mobile data
- Hazard assessments for use in other applications, such as variable speed limits and truck routing
- Develop high wind/blowover hazard product
- EMDSS and MAW functionality may be leveraged for commercial traffic use and WYDOT road maintenance/closures



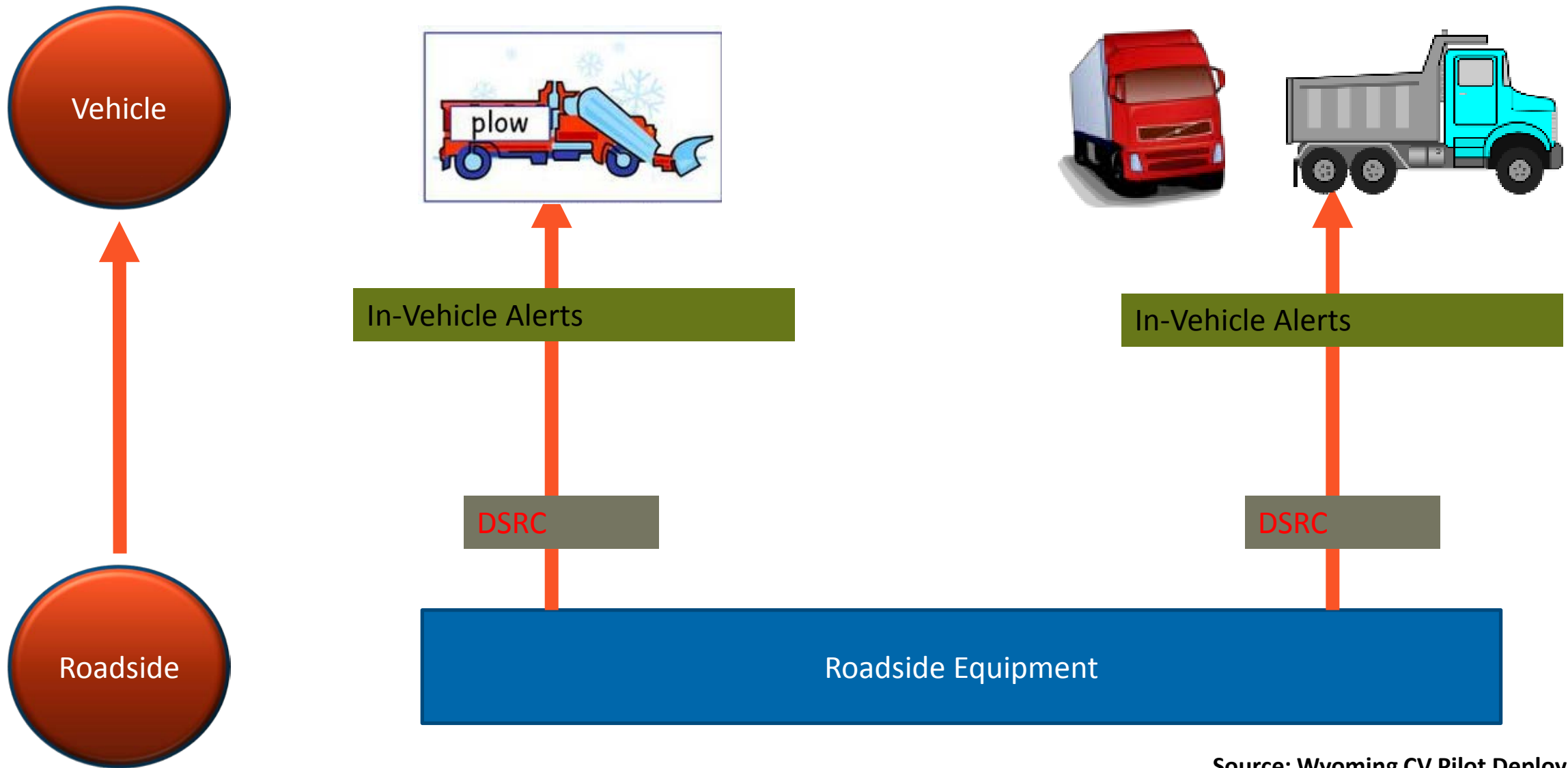
Source: NCAR

Pilot Components (4/6)



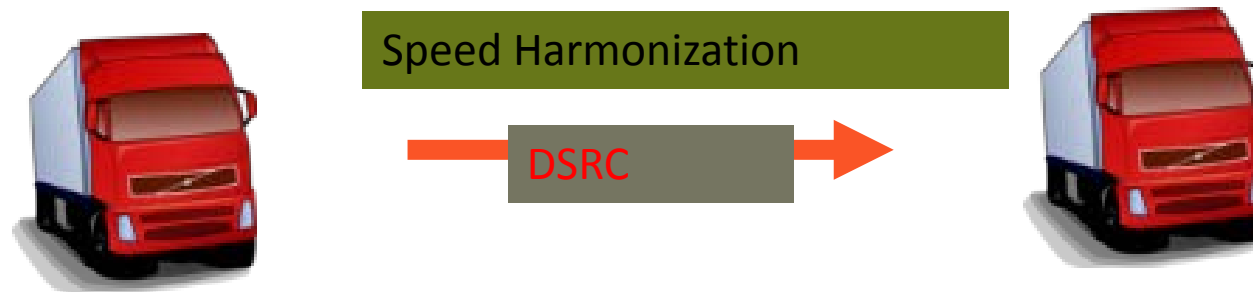
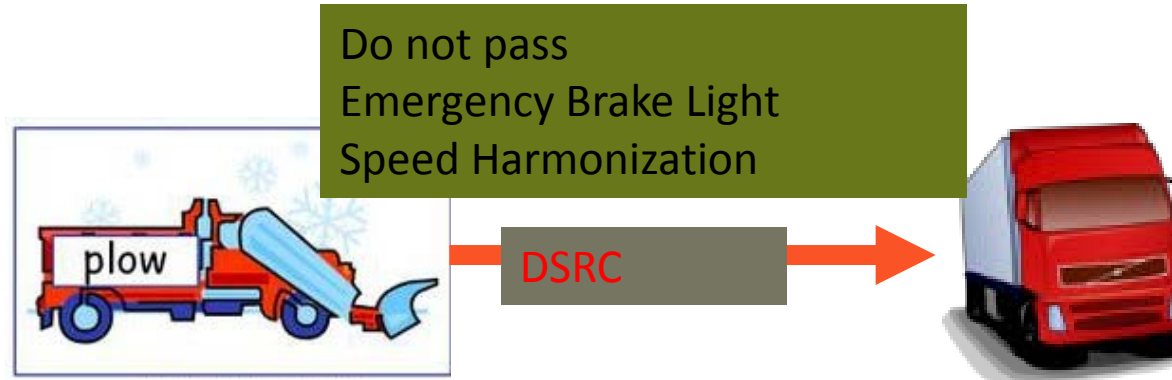
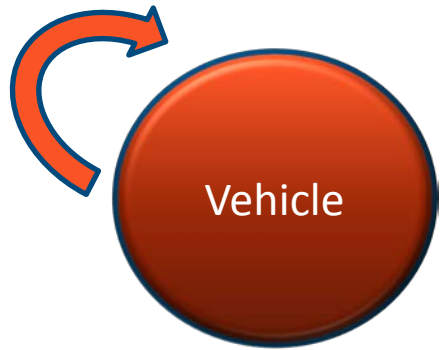
Source: Wyoming CV Pilot Deployment Team

Pilot Components (5/6)



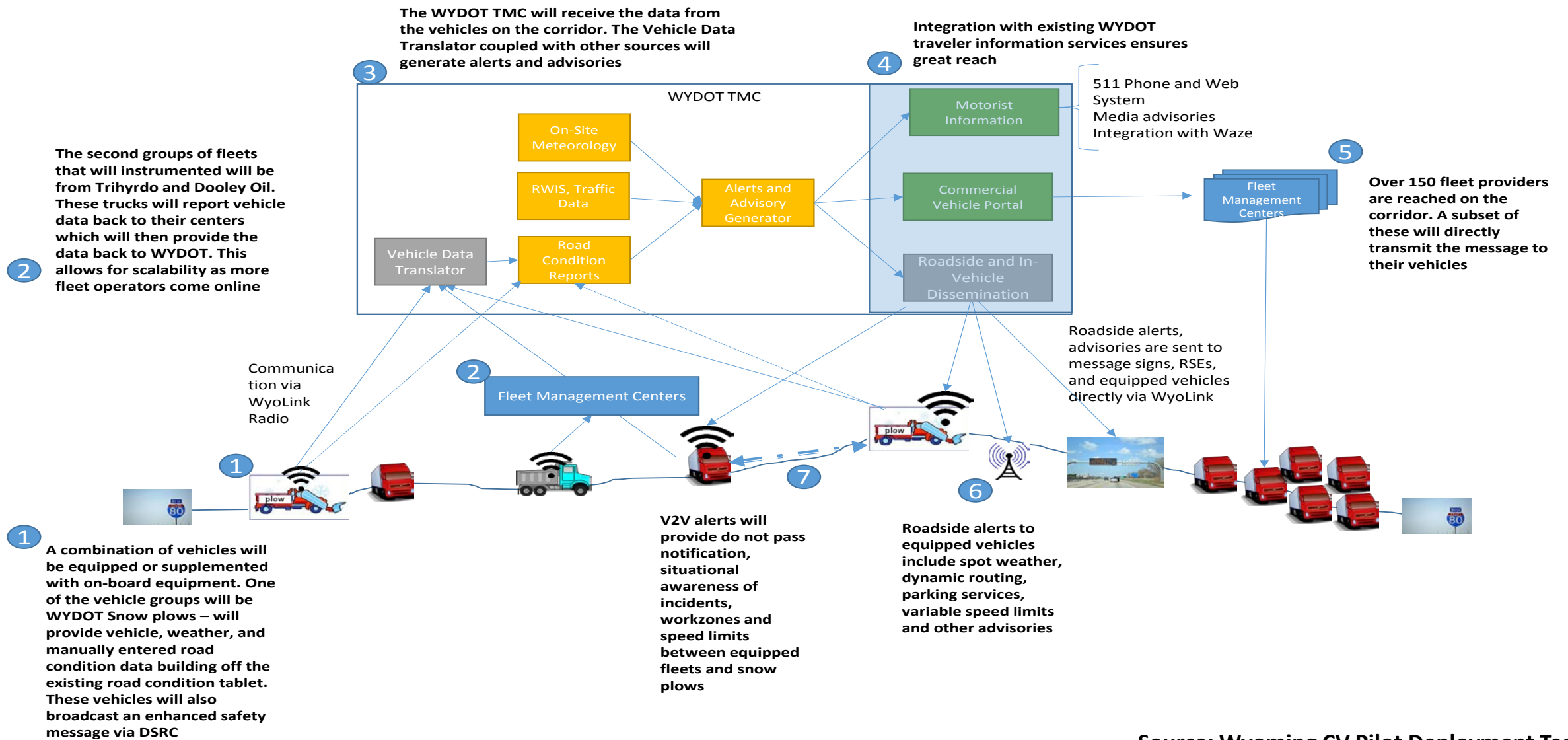
Source: Wyoming CV Pilot Deployment Team

Pilot Components (6/6)



Source: Wyoming CV Pilot Deployment Team

Another View



Source: Wyoming CV Pilot Deployment Team

Proposed CV Applications for Development

- **Initially focused on Motorist Alerts and Advisories relating to weather conditions**

- Spot Specific Weather Warnings
- Variable Speed Limits
- Speed harmonization

- **Create platform for future use based on user needs**

- Work Zone Alerts
- Truck Restrictions
- Truck Parking
- Curve Speed Warnings
- Route guidance

Also, existing traveler information sources (511, website, CVOP, app) will all be improved to incorporate information from connected vehicles

Anticipated Impacts

- **Reduction in the adverse weather related incidents (including secondary incidents) in the corridor in order to improve safety and reduce incident-related delays**
- **How**
 - Reducing the latency and increase the coverage of road condition reports along the I-80 corridor by gathering data from equipped snow plows and trucks
 - Adding in-vehicle dissemination of advisories to support speed management, detours, parking and presence of maintenance and emergency vehicles
 - Building linkages with fleet management center operations by providing current and forecasted road conditions along I-80
 - Developing local vehicle to vehicle communication of road condition and posted speeds along the I-80 corridor especially in the variable speed limit zones, work zones and around maintenance fleets

Key Risks/Challenges

- **DSRC communication not tested yet on I-80 corridor conditions**
- **Aggressive schedule may limit ability to engage diversity of stakeholders**
- **Capability of mobile weather sensors and vehicle telematics to accurately portray road weather condition is still nascent in the industry**
 - Some parameters are highly accurate, others are of unknown accuracy, and others are not available
- **Limited understanding of how best to provide in-vehicle road condition data from a human factors standpoint**
- **Schedule closely tied to winter seasons**



Implementation Approach

Implementation Strategy in Phase I

- **Vendor-Neutral Approach to Phase I**

- **ICF – Lead Contractor**

- SubConsultants – Trihydro, McFarland Mgmt, University of Wyoming, Univ of Maryland –CATT Lab
- Partner – Wyoming DOT

- **Strategic Focus Areas**

- Ensure traceability between documents
- Understand and support evaluation needs early in ConOps development
- Develop detailed plan for training needs and obtaining buy-in from truck and snow plow end-users
- Inventory and leverage federal research investments as much as possible
- Develop a branding and outreach strategy to support both internal and external marketing needs
- Develop and cultivate an active stakeholder group in Wyoming around this project.
- Collaborate and learn from other CVs
- Engage with vendors and telematics data providers for alternative analysis
- Deliver on-time

Implementation Strategy in Phase II and Phase III

- **Wyoming DOT will be the lead agency for development and deployment in Phase II**
- **Team roles (ICF and others) will be revisited as part of Phase I implementation planning**
- **New vendors/partners will be added to the team**
 - DSRC Radio providers
 - Weather Data Providers
 - Freight Telematics
 - Fleet Management
- **Strategic Focus**
 - Develop robust testing and acceptance plan
 - Integrate with existing WyDOT network and systems
 - Support evaluation data needs and participation in RDE
 - Open source development as much as possible

Emphasis on Systems Engineering Management

- Leverage the CVRIA framework for the development of mobile data collection, in vehicle advisories for wind, speed limits, and parking availability using DSRC and cellular communication for V2V and V2I applications
- Use the SET-IT tool to develop the Enterprise, Physical, and Communications View for the CVRIA applications and build the initial draft for the Task 2 Pilot Deployment Concept of Operations (ConOps) document components for system engineering management
- Leverage existing federal research and prototypes
 - PikeAlert
 - MAW
 - INFLO
 - RESCUEME
 - SWIW

Support Evaluation and Performance Measurement

- **Performance Measurement Plan development will occur early in the project concept development**
 - Ensures a project design that focuses on outcome benefits and is prepared to collect the necessary data
 - Closely coordinated with Task 2, Concept of Operations and Task 6, System Requirements
- **Approach**
 - Key performance measures will focus on increasing safety and improving operational efficiencies
 - Surrogate measures will be established, where appropriate
 - Impacts of CV Pilot use-cases; input-output-outcome logic models
 - Modeling and simulation will be utilized to enhance data analysis and performance measurements in the areas of safety, operational efficiencies, and road weather impacts related to freight movement operations
 - Continuous data collection and support to independent evaluation activities

Stakeholder Involvement

- **List of Stakeholders**

- Wyoming Trucking Association
- Trucking companies
- Truck stops and services
- Emergency Responders
- WYDOT employees
 - Telecommunications
 - Maintenance Supervisors and Drivers
 - TMC
 - Wyoming Highway Patrol
- Wyoming Citizen Panel
- National Weather Service
- Representatives from Cities on I-80
- Oil and Gas industry representatives

- **Involvement in Phase I**

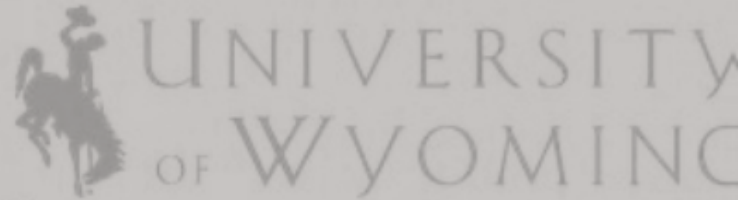
- User Needs Development
- ConOps Review
- Gathering Commitment for Phase II



Next Steps

Next Steps

- **Complete Project Management Plan (PMP) and Systems Engineering Management Plan**
- **Develop Stakeholder Registry**
- **Develop internal communications portal for the team and FHWA**
- **Begin Concept of Operations Development**



McFARLAND MANAGEMENT, LLC