

Working
NATIONAL ^SUMMIT ON
TRANSPORTATION IN RURAL AMERICA



National Center for
Rural Road Safety

Sept. 7-9, 2016 | Denver, CO

Addressing Rural Challenges: Technology and Connected Vehicles



Blaine D. Leonard, P.E., F.ASCE
ITS Program Manager
Utah Department of Transportation



CHALLENGES WE FACE

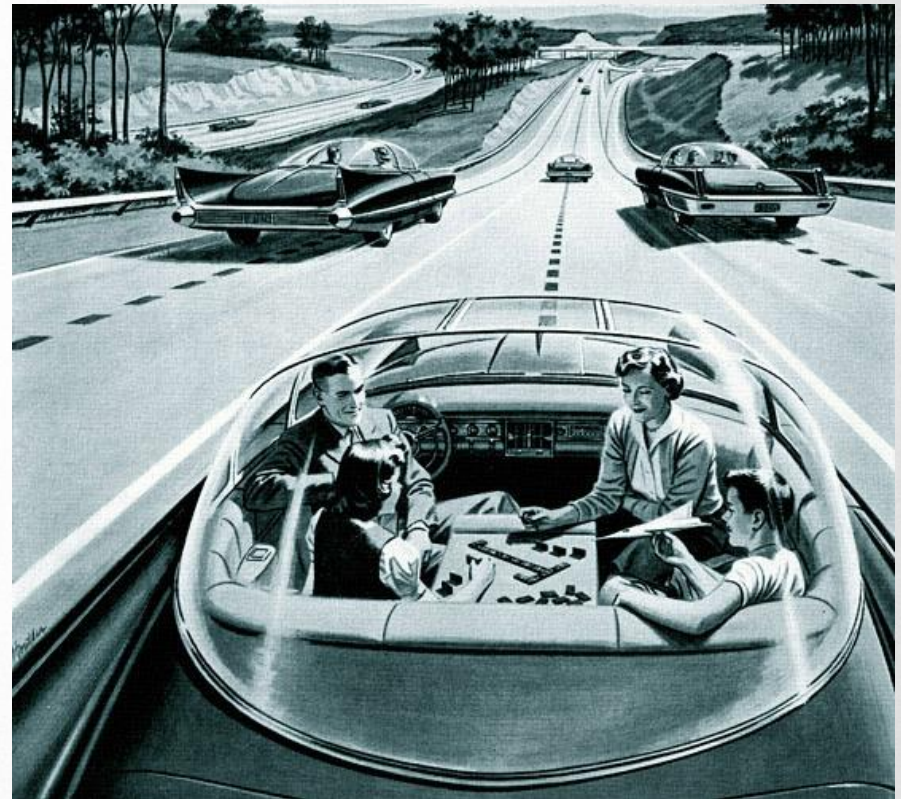
- Congestion
- Safety
- Travel and Transit Reliability
- Expanded Traveler Information
- Truck Parking (I-15 / I-80 / I-70)
- Managing Freight Movements
- Winter Inversion / Poor Air Quality
- Specific Road Weather Information
- Reliable / Real-time Construction Information

**CONNECTED VEHICLE
TECHNOLOGY
CAN HELP US**

- New Technologies:
 - Automated vs. Connected Vehicles
 - What is Happening, and Where?
- Connected Vehicle Applications
 - Early Applications
 - Rural Applications
- Tools and Resources

AUTOMATED VEHICLES

Electricity may be the driver.
One day your car may speed along an electric super-highway, its speed and steering automatically controlled by



AUTOMATED VEHICLES

- Automated Features:

- LiDAR
- Digital Imagery
- Radar
- GPS



- Open Road Testing in:

- Mountain View CA, Phoenix, Austin, Kirkland WA
- 1.5 million self-driving miles

VEHICLE AUTOMATION

THE TRANSITION BETWEEN PARTIALLY AND HIGHLY AUTOMATED DRIVING REPRESENTS A MAJOR STEP.



STEP CHANGE

Driver performs longitudinal AND lateral control at all times.

Driver performs longitudinal OR lateral control at all times.

Driver must actively monitor the system at all times.

Driver no longer needs to actively monitor the system.

Longitudinal and lateral control tasks are performed entirely by the vehicle, within specific applications. The driver does not need to monitor the system.



e.g. Speed Limit Info

No actuated assistance systems.



e.g. Parking Assistant

The other (longitudinal or lateral) control task is performed by the vehicle.



e.g. Traffic Jam Assistant

Longitudinal and lateral control tasks are performed by the vehicle (for a certain period of time and/or in specific situations).

Longitudinal and lateral control tasks are performed by the vehicle (for a certain period of time and/or in specific situations).

Regulated by law and introduced into the market.

Not regulated by law and under research.

Driver only

Assisted

Partially automated

Highly automated

Fully automated

EXISTING AUTOMATED APPLICATIONS

- Lane Departure Warnings / “Lane Assist”
- Adaptive Cruise Control
 - Freeway Driving: automated braking, acceleration, lane change
- Collision Warning
- Automated braking
- Unoccupied self parking



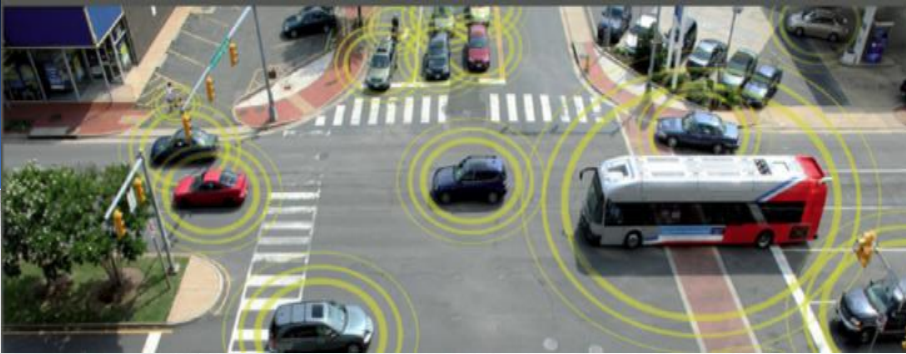
“By the time we get to the
autonomous vehicle,
it won’t be that big of a deal”

- Bill Ford,

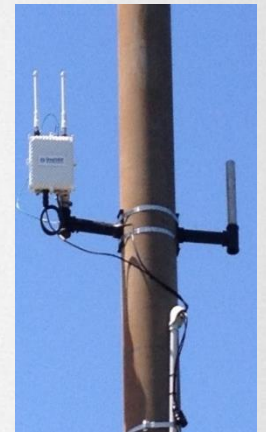
Executive Chairman, Ford Motor Co



CONNECTED VEHICLES

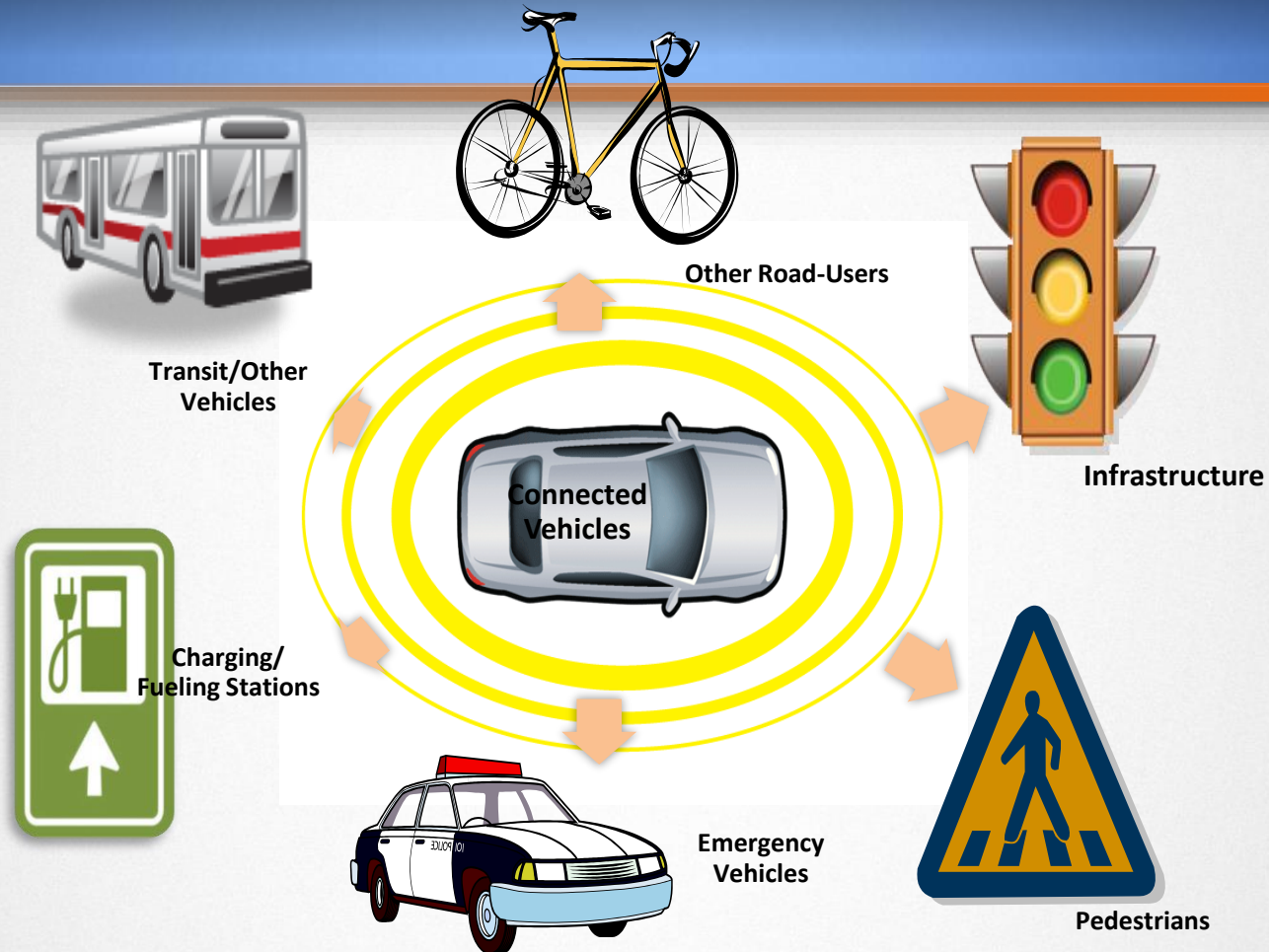


- The Connected Vehicle system will combine technologies:
 - advanced roadside infrastructure,
 - wireless communications,
 - advanced vehicle sensors,
 - onboard computer processing, and
- – to provide vehicles the capability **to detect threats** and hazards on the roadway and to **communicate** this to the driver through alerts and warnings.



5.9 GHz DSRC Radio

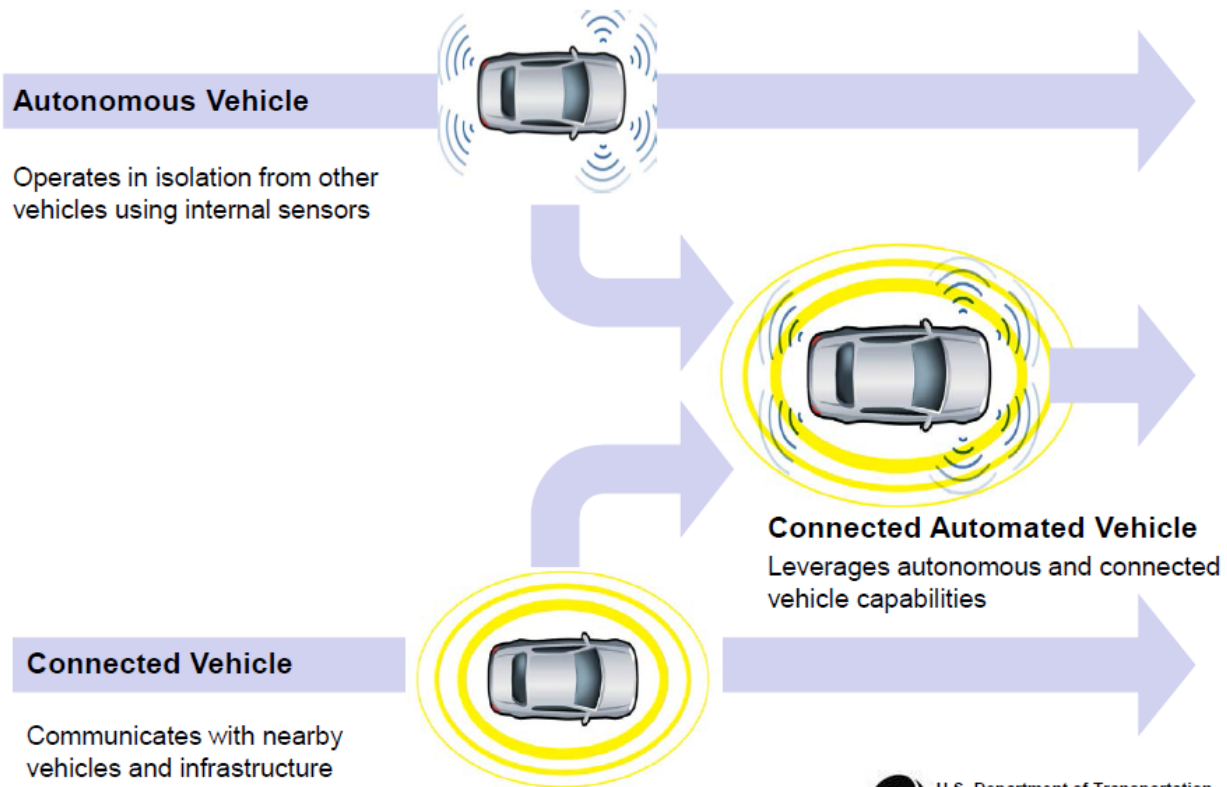
CONNECTED VEHICLES



Could potentially address up to 80% of non-impaired driver crash scenarios

CONNECTED AUTOMATION

Connected Automation for Greatest Benefits



WHEN WILL THESE CHANGES TAKE PLACE?

- Today – Automated features on many new cars
- 2017 – GM to have DSRC on luxury models
- 2020 – Google / Ford driverless car available
- 2020 – DSRC on all new light vehicles
- 2020 – Highly automated car available (BMW)
- 2025 – Fully automated car available (Bosch)
- 2035 – Most cars will have DSRC on board



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)

Road Weather

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

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

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

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

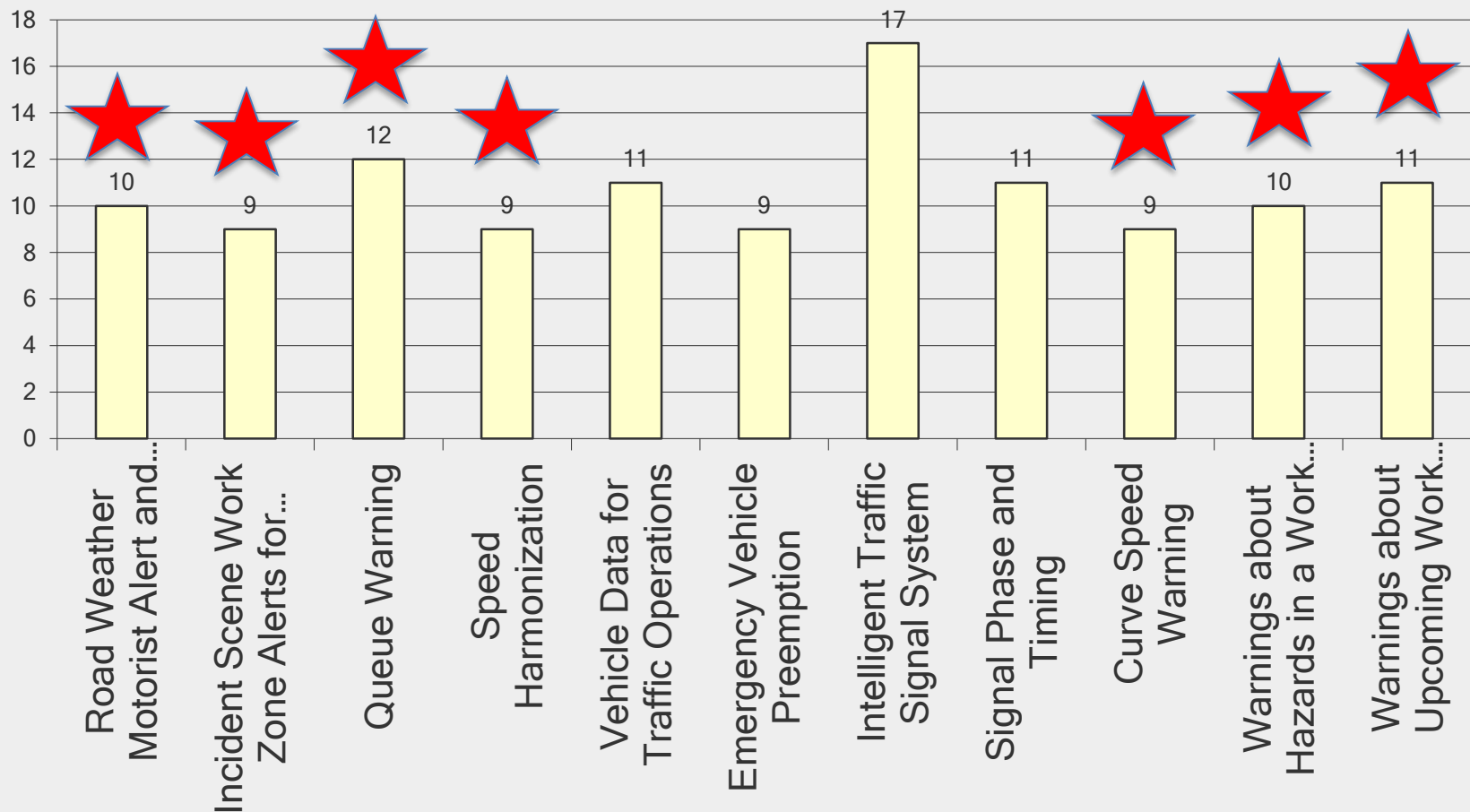
Smart Roadside

Wireless Inspection
Smart Truck Parking

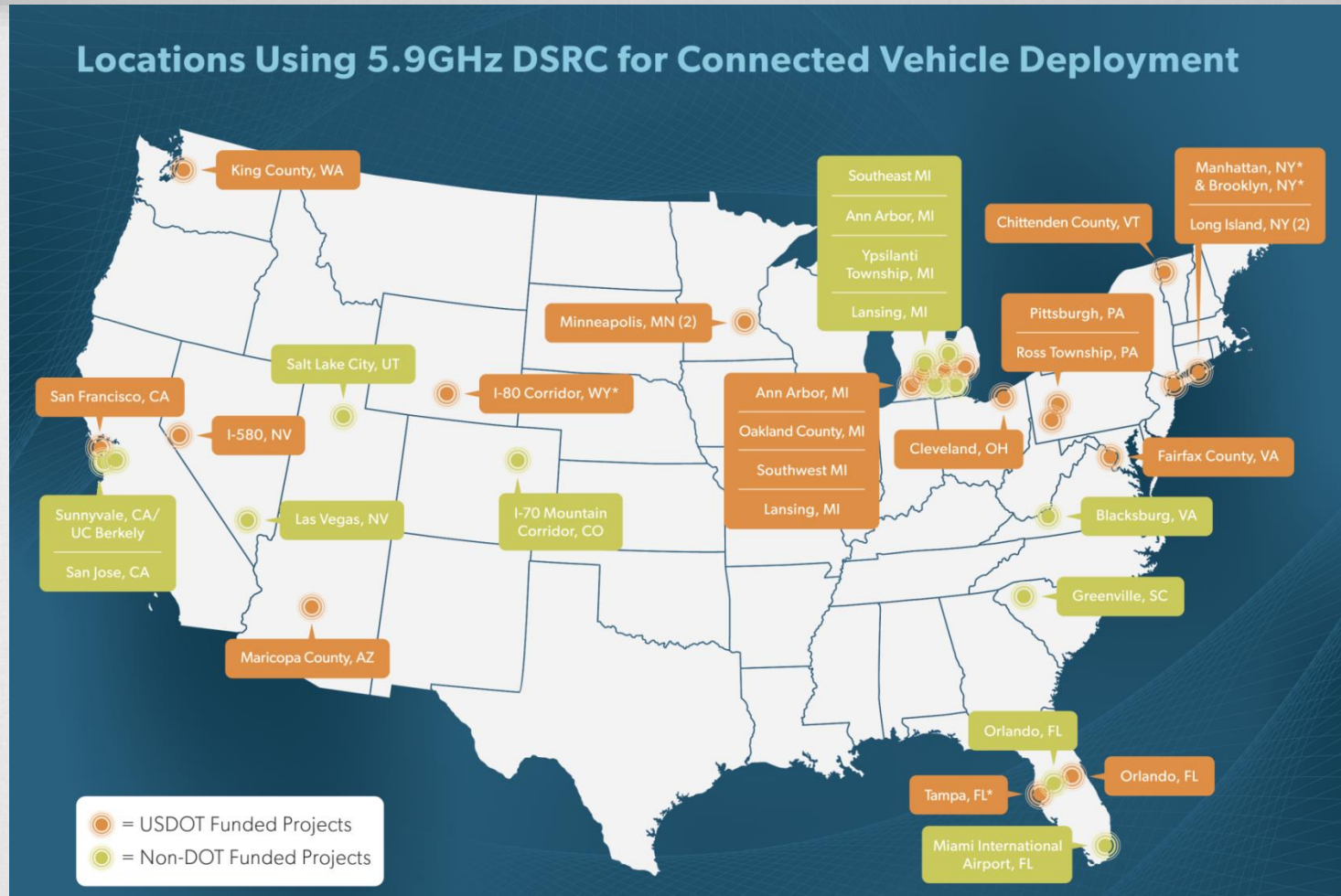


CV APPLICATIONS INCLUDED IN PLANS OR PROPOSALS

Question 3: CV Applications Included in Agencies Plans or Proposals for Deployment
(Top 11 Applications Selected; # of Responders = 21)



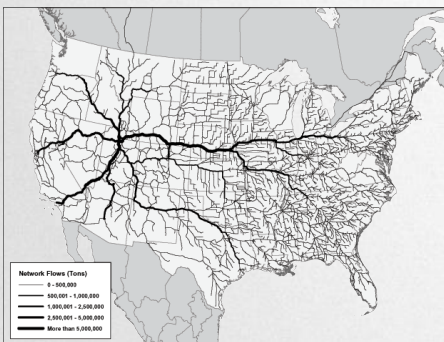
DSRC DEPLOYMENTS



Source: Kevin Gay, USDOT and Suzanne Murthy, OmniAir Consortium

RURAL CONNECTED VEHICLE APPLICATIONS

- Freight Mobility
 - Truck Parking (Michigan)
 - Winter Driving Conditions / Information
 - Traveler Information including crashes
 - Inspection / Regulatory
 - Technology, such as Platooning
 - Probe / Data sharing



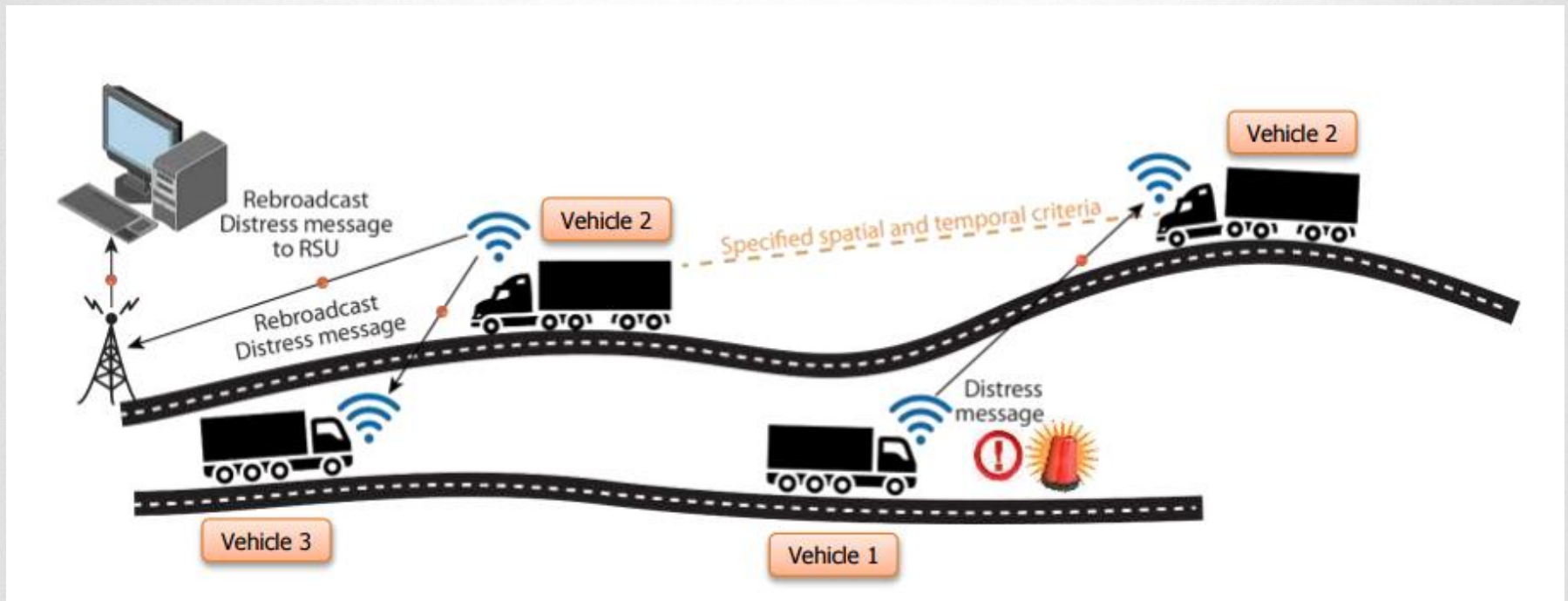
RURAL CONNECTED VEHICLE APPLICATIONS

- Weather Information and Warnings
 - Snow Plows as mobile cameras and probes
 - Variable Speed Limit (Wyoming)
- Work Zones
 - Lane Closure Information / Work Zone Traveler Information
 - Worker Safety
- Safety Information
 - Bridge Height
 - Curve Speed Warnings
 - Queue Warnings



RURAL CONNECTED VEHICLE APPLICATIONS

Wyoming Pilot Idea



Source: Wyoming CV Pilot Comprehensive Deployment Plan Webinar

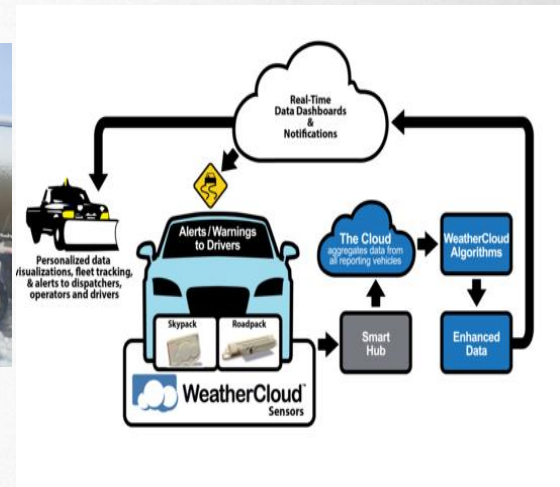
UTAH APPLICATION DEPLOYMENTS

- Multi-modal Intelligent Traffic Signal System (MMITSS)
 - Urban signalized intersection application

- Rural Weather Probes
 - US-40 to SLC



- Truck Platooning
 - Peloton



CONNECTED VEHICLES

- What **investments** could be made to leverage a nationwide fleet of equipped vehicles in support of **state and local policy and operational objectives including safety**?
- Important issues for state and local agencies:
 - What the deployment decision could mean to you
 - How do you get started?
 - What you need to know to prepare for the emerging connected vehicle environment

TOOLS AND RESOURCES

AASHTO

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AASHTO
SUBCOMMITTEE ON TRANSPORTATION

STSMO

- Home
- Annual Meeting
- National Operations Center of E...
- Strategic Plan
- Membership
- Systems Operations Strategies
- Performance Measures
- TSM&O Research
- Traffic Incident Management
- Connected Vehicles
- Ballots
- Resources

Connected Veh

AASHTO > Subcom

AASHTO W

- 1-AASHTO
- 2-CAM
- 3-Tom
- 4-Walt
- 5-Krueger
- 6-Taso
- 7-Derr
- 8-Gumi

USDOT Co

United States Department of Transportation

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Intelligent Transportation Systems Joint Program Office

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Planning for the Future of ITS

Current Research

- Strategic Plan 2015-2019
- Safety
- Mobility
- Environment
- Road Weather
- Policy
- Connected Vehicle Technology
- Intermodal Research
- Exploratory
- ITS Open Call Support

ITS AMERICA

SEARCH

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Councils & Forums

- Policy and Business Council
- State Chapters Council
- Coordinating Council
- Safety
- Transportation Management
- Commercial & Freight
- Sustainability
- Emerging Technologies
- Join a Forum
- Connected Vehicle Task Force
- First Responder (TSAG)
- ISO/TC204 - Main Page
- TC204 Meetings Calendar
- ISO/TC204 - Public Documents
- ISO/TC204 - Ongoing Ballots
- ISO/TC204 - Recently Closed Ballots

The Connected Vehicle - Next Generation ITS

The Real "Car Talk" - Vehicles that Can Communicate with Each Other

The U.S. DOT Research and Innovative Technology Administration (RITA) \ ITS Joint Program Joint Program Office (ITS JPO) is the major sponsor of the Connected Vehicle program. Connected Vehicle focuses on localized Vehicle-to-Vehicle, Vehicle-to-Infrastructure and Vehicle-to-Device Systems (V2X) to support safety, mobility and environmental applications using vehicle **Dedicated Short Range Communications (DSRC)** **Wireless Access for Vehicular Environments (WAVE)**. This program has support from most of the automakers and a number of state departments of transportation.

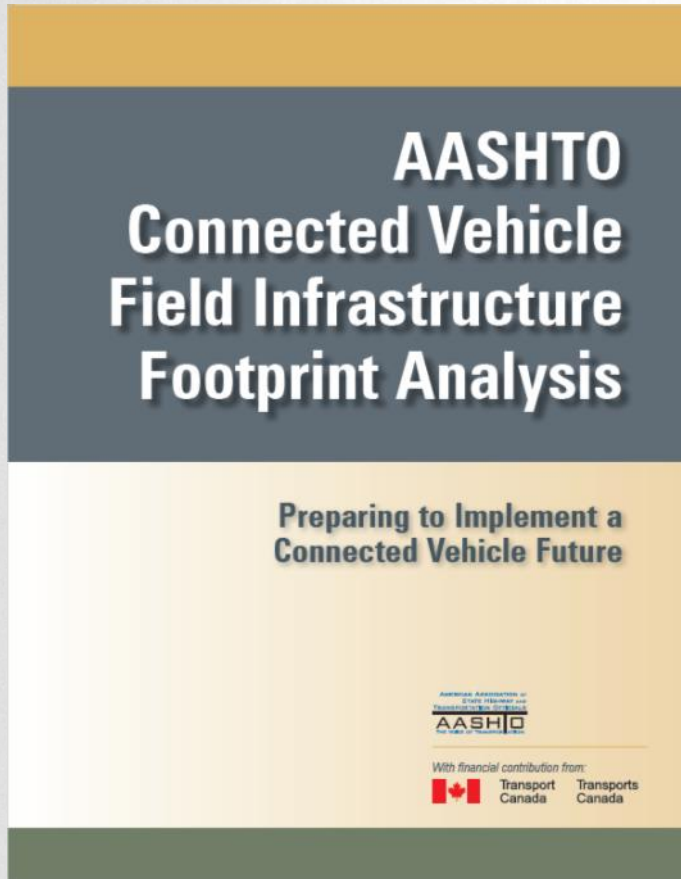
The **ITS America Connected Vehicle Task Force** addresses a number of challenges and explores opportunities to achieve deployment of short range vehicle-to-X safety and mobility applications and related wireless communications-based intelligent transportation systems. Issues examined include technical risks such as ensuring interoperability and security; and institutional risks such as addressing liability and privacy issues, meeting stakeholder needs, and ensuring system sustainability.

The ITS America Connected Vehicle Task Force does this through dialogue with industry and public sector members, focusing on the challenges of establishing viable public-private partnerships and business models. These models are ones that that make deployment attractive for both industry and the public sector, that ensured long term technical support and implementation, and assist USDOT, the FCC and state and local authorities in establishing leadership and governance where needed.

With the globalization of the auto-industry and active vehicle communications research programs in other countries, the ITS America Connected Vehicle Task Force also seeks cooperation and lessons learned through international partnerships with association counterparts such as ITS Japan, ITS Canada, Europe's ERTICO, and their stakeholders.

ITS America and the ITS America Connected Vehicle Task Force also interfaces with the Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE), the American Association of State Highway Transportation Officials (AASHTO), The International Road Federation (IRF), the Society of Automotive Engineers (SAE), the Consumer Electronics Association (CEA), and CTIA - The Wireless Association, among others. The Task Force also works to

TOOLS AND RESOURCES



AASHTO Footprint Analysis

- A vision of a national CV infrastructure
- Guidance on:
 - Regional & Nat'l Infrastructure Needs
 - Illustrations of typical deployments
 - System and equipment needs
 - Siting requirements
 - Operations & maintenance issues
 - Deployment cost estimates

TOOLS AND RESOURCES

- **FHWA Deployment Guidance**

- Planning
- Procurement
- Benefit Cost Analysis
- Interoperability
- Communication Technology
- Hardware Certification
- Security Management / Data Access / Privacy
- Legacy Systems
- Systems Engineering Process
- Deployment Guidelines / Best Practices

Help communities
prepare for
connected vehicles

Available late 2016

GETTING INVOLVED

- AASHTO Connected and Automated Vehicle Working Group
 - Within the STSMO structure
- Connected Transportation System Pooled Fund Study
 - Lead state: Virginia DOT
- V2I Deployment Coalition
 - Joint effort of AASHTO, ITS-America, ITE
 - Five technical working groups
- ITS-America Connected Vehicle Task Force
- ITE Connected Vehicle Task Force



SPaT DEPLOYMENT CHALLENGE

AASHTO & V2I Deployment Coalition Effort

Encourage agencies to deploy DSRC – broadcasting the “signal phase and timing” message – on their corridors

20 Signals along a corridor in each state

Spur Deployment

Connected Vehicle Deployment Challenge 20 SPaT Intersections in 50 States by 2020

The Challenge:

Equip at least one corridor (roughly 20 signalized intersections) in each of the 50 states with Dedicated Short Range Communications (DSRC) infrastructure to broadcast SPaT information by January 2020, and maintain operations for at least 10 years.

What is SPaT:

A Signal Phase and Timing (SPaT) message defines the current intersection signal light phases. The current state of all lanes at the intersection are provided, as well as any active pre-emption or priority.

Why This Challenge/Goal is Needed:

- To provide State and Local DOTs with an entry into DSRC based V2I Deployment (allow them to gain valuable procurement, licensing, installation, and operation experience)
- To promote future (more advanced) V2I deployments
- To show a commitment to automobile manufacturers and applications developers

“Fortunately, there is one fairly basic connected vehicle element which is relatively simple to deploy and fundamental to a number of applications, the “signal phase and timing” (SPaT) message. SPaT defines the actions of a traffic signal. It is obtained from a traffic signal controller via a standard query protocol and is broadcast by most DSRC roadside devices as a standardized data message.”

- Blaine Leonard, Utah DOT ITS Program Manager



Deployment Tools Will Be Available

The following tools will be developed:

- Guidelines for selecting corridors
- Procurement guidance
- DSRC licensing information
- Installation guidance
- Estimated costs
- Identification of existing funding sources that agencies may consider

Success in meeting the Challenge will be Measured

The V2I Deployment Coalition will work with the National Operations Center of Excellence (NOCoE) to maintain a website to track progress using a national map to depict locations where:

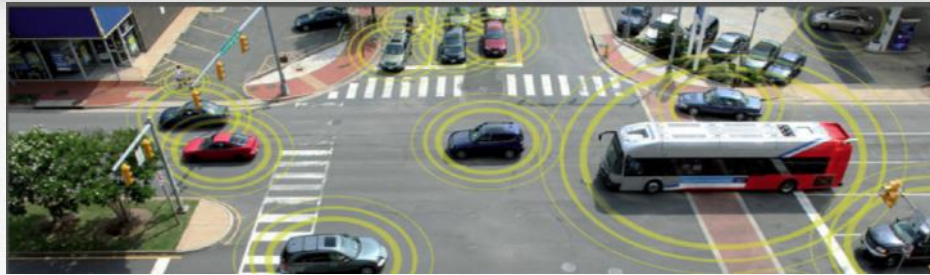
- There is a commitment to deploy, and
- DSRC SPaT broadcast is operational.



How to get involved?

The Connected Vehicle SPaT Deployment Challenge is being led by the V2I Deployment Coalition TWG 1 and the AASHTO CAV WG. Information is available at: <http://www.transportationops.org>. Infrastructure Owners & Operators wishing to join the challenge, or others wishing to participate in the effort, may contact: Dean Deeter (AASHTO support liaison to both groups) at deeter@acconsultants.org

THE TAKE-AWAY



- Connected and Automated Vehicle Technologies can – and will – help improve rural safety and traveler information
- There are resources to help us begin deployments
- There is no better time than now

QUESTIONS / DISCUSSION

